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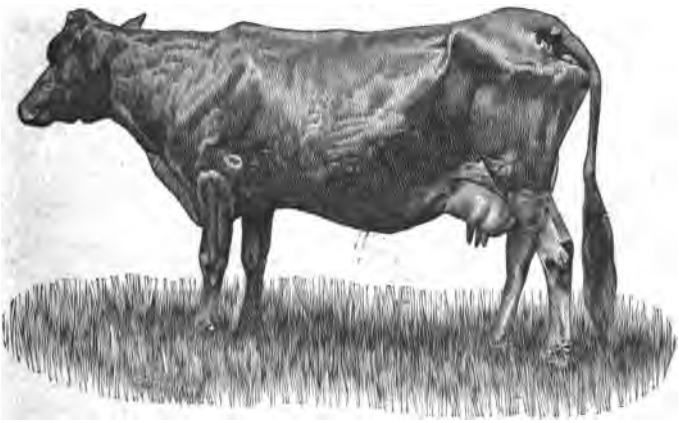

MISSOURI DAIRYING.

COLUMBIA, MISSOURI.

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Summary of Crop Reports.	State.....	Northeast....	Northwest....	Central.....	Southwest....	Southeast...	
Wheat, condition	95	97	99	95	95	87	%
Wheat likely to be plowed up..	1	2	1	1	1	1	"
Oats, acreage compared with 1900	98	101	96	96	99	100	"
Oats, amount now sown..	24	8	2	16	44	52	"
Meadows, condition.....	91	95	97	90	91	84	"
Clover, condition.....	88	86	94	88	87	85	"
Apple buds alive.....	92	89	93	92	96	91	"
Peach buds alive.....	86	80	77	88	92	92	"
Small fruits, condition.....	91	92	88	94	90	90	"
Horses, condition compared with average.....	98	99	99	98	99	96	"
Mares that will foal this spring.	60	66	61	66	56	53	"
Cattle, number now on feed, to be marketed before grass, compared with 1900..	77	81	74	75	73	84	"
Cattle, number that will be fed on grass, compared with 1900.	91	89	90	90	89	95	"

Part I.

MISSOURI CROP REPORT.

Columbia, Mo., April 3, 1901.

The following summary of crop and live stock conditions in the State, on April 1, is made up from reports furnished by more than 400 correspondents representing 105 counties:

WHEAT.—The condition of the wheat crop is excellent with the exception of a very few localities reporting damage from Hessian fly, and a few counties in the Central and Southeastern sections reporting damages on dry upland freezing out. The highest average condition, 99 in the Northwest, is followed

closely by 97 in the Northeast, and 95 in Central and Southwest with only 87 in Southeast. That likely to be plowed up only 1 per cent, with a slight increased acreage over 1900, and the average 5 per cent above 1900 and 34 per cent higher than 1899. The outlook is at this time encouraging.

OATS.—Owing to wet weather sowing has not progressed very well, only one-fourth of the entire crop for the State reported sown, the highest being 52 per cent in the Southeast, followed by 44 per cent in Southwest, 16 per cent in Central, 8 per cent in Northeast and only 2 per cent in Northwest. If unfavorable weather continues many days a considerable decrease in acreage may be expected.

CLOVER AND TIMOTHY.—Condition reported 88 per cent for the State; the highest 94 per cent in the Northwest and lowest 85 per cent in Southeast. Considerable damage reported on account of drouth last fall, but what remains condition generally good. Timothy is in good condition, the average being 91 per cent.

FRUIT.—Many correspondents report "best prospects we have had for many years" and peaches ready to bloom in some southern counties. Careful attention to spraying and combating insects and "bitter rot" will perhaps insure an old-time fruit crop in the State. Apple buds alive 92 per cent, peach buds 86 per cent, small fruits condition 91 per cent.

LIVE STOCK.—An abundance of feed, and stock generally in good condition, are reported from all parts of the State. A few counties report cholera among the hogs and some others report horses having died from the effects of wormy corn. Farmers are awakening to the importance and profits of raising good horses and a number of counties report that two or three times as many mares will foal this spring as last, with the average number for the State at 60 per cent against 47 per cent last year. Horses are generally reported scarce and in good demand at increased values.

CATTLE.—On account of better prices for corn and a scarcity of feeding cattle, only 77 per cent of the number of cattle fed last year are now on feed to be marketed before grass, with 91 per cent compared with 1900 to be fed on grass. Taking the general outlook, the farmers of the State have reason to be encouraged with the prospects for the first year of the Twentieth century.

Part II.

THE STATUS OF THE DAIRY INDUSTRY IN MISSOURI IN 1901.

We can not record such a condition of dairying in this State at this time as a pardonable State pride would permit, but we have abundant reasons for being encouraged on account of what has been done and for the evidences of a new era in dairy development which is now dawning. It matters not now what has been the cause that has kept us in the background in dairy farming in the past, whether it has been the natural conservative disposition of our people, or whether it has been because of our comparatively cheap lands and a productive soil, making grain farming and beef and pork raising very profitable, or whether it has been because of a lack of the knowledge necessary to the successful carrying on of the business, let us consider conditions as we find them to-day and the progress we may reasonably expect in the near future.

The gathering of trustworthy and reliable data upon any subject in and for a great State like Missouri, and that without the aid of any legal authority, or the financial support necessary, is an undertaking that requires time and energy and is often met with disappointment.

Since taking charge of this office the first of the present year, we have made some effort to find out what the present status of the dairy condition is, and while our reports are at this writing very imperfect, we shall continue with the aid of those interested until a complete and reliable report can be made of this important business in this State.

From the State Auditor's report we learn that there were in Missouri on June 1, 1900, about 2,172,872 cattle, from which we estimate that there are 723,000 cows or more. Making a reasonable estimate for the number that are used for breeding purposes only, we think it a safe figure to place the number of cows in the State available for dairy purposes at 500,000. A large number of these cows are used for raising calves and for the production of milk and butter for home consumption, and after the calves are weaned the cows are dried off and "roughed" through the winter, thus producing but a very small profit to the owner above the cost of keeping. A considerable number of cows are kept in private milk dairies that furnish milk directly to the consumer in towns and cities. From reports received from forty milk dairies located in different parts of the State and probably representing a fair average condition, we find that the average annual production per cow is 4,100 pounds of milk, calculated at the average price received per 100 pounds, makes an average per cow of about $51.25 gross receipts.

For about the same number of butter dairies the average annual production is 252.5 pounds of butter per cow, calculated at the average price received for butter, 23 cents, makes $58 per head, not counting the skim milk.

From about thirty creameries and skimming stations reporting more than 10,000 cows, the average number of pounds of milk received per cow is 4,000 pounds, average price paid for milk at 73.3 cents per hundred makes $29.32 per head.

From eleven cheese factories reporting about 1,700 cows, an average of 3,514 pounds of milk per cow is made at 75 cents per hundred pounds, the average price reported for milk, makes only $26.35 per head.

There are probably more than two hundred creameries and skimming stations in the State, perhaps thirty or forty cheese factories, and a large numbere of private milk and butter dairies. From the reports we have at hand, aided by the census figures of 1890, we estimate the number of cows furnishing milk for these purposes to be 100,000. If these produce an annual product worth $45, which is much below that made by either the butter or milk dairies reporting, but above the amount for the creameries, we have a total value of $4,500,000. We estimate that 400,000 cows are kept on the farms primarily for raising calves, but from which a considerable quantity of butter is produced for home consumption and the surplus sold to local trade or to shippers. These cows produce upon an average 100 pounds of butter that sells for 12½ cents per pound, which makes a total value of $5,000,000. To this should be added the value of the skim milk which is worth at a low estimate $2.50 per cow or $1,250,000 making a grand total of nearly $11,000,000 worth of dairy products for the State.

This is certainly not a bad showing when we take into consideration the fact that practically nothing has been done to develop the industry in Missouri. This calculation, it will be seen, does not reckon the value of the manure returned to the land or the calves annually raised, which at a low estimate would add not less than $10,000,000 to the amount.

THE FUTURE OF THE DAIRY INDUSTRY IN MISSOURI.

With a climate as favorable as the best dairy countries of the world, possessing a soil equal to if not superior to the same

area anywhere on earth that will produce abundantly the best of dairy feeds at a nominal cost, accessible to splendid markets that are found within our borders and at our western door, with more than one-half million cows now in our pastures that may be brought into service, and last but not least an honest, industrious and intelligent people, who is ready to say that with a little encouragement from the State, it is impossible or improbable that Missouri may in another decade become one of the leading dairy producing States in the Union.

STATE ENCOURAGEMENT.

The last General Assembly recognized the importance of this industry when it provided by law for the establishment of a Chair of Dairy Husbandry, in the College of Agriculture and made an appropriation of $5,000 to sustain it. The authorities of the College assure our people that this Chair will be filled by an up-to-date practical dairyman, whose time, for the present at least, will be given entirely to field work. He will travel over the State, hold schools of instruction, and give private information where possible upon all the details of the business, thus taking the dairy Department of the College of Agriculture to the very door of the farmer.

The Forty-first General Assembly further provided, at a cost of $40,000, for building and equipping a dairy and live stock building on the grounds of the College of Agriculture, where the very best equipments will be furnished and the most competent teachers obtainable will be employed. Will our farmers take advantage of this splendid opportunity to give their boys on the farm what the State offers free of cost? We do not think it necessary to argue with the farmers, the benefits to be derived from a special and technical training. If, however, any of our readers doubt the value of this knowledge we refer them to the results of our reports, which show that one pound of butter produced by up-to-date methods brings in

the market an average of 23 cents per pound, while the average butter carelessly handled will bring but 10 or 12 cents per pound. Most of this difference is frequently caused by the difference in handling and marketing after it is made.

WILL IT PAY.

This is perhaps the first question a man will ask, and very properly so, when investing in a new business. It is certainly not the province of this bulletin to advise farmers who are meeting with a good degree of success in their business as now followed, to make any change. There are hundreds of farmers engaged in raising pure bred or high grade cattle in this State who are making a success of the business and the time will never come, in our opinion, when the production of first-class breeding cattle, or good beef cattle will to any great extent be overdone. It may be that owing to local conditions there are localities in Missouri where on account of mild winters and long summers, coupled with cheap lands, that cows may be profitably kept for the raising of calves only. But eliminating all of those who are breeding pure bred cattle, and all who are reasonably well satisfied with the profits of their business, there are thousands of others whom we think we can show by actual results obtained by others, who can very profitably go into the business of dairying.

Take first the large number of cows on our farms. What are they producing under present methods? In making our calculations for the following comparisons, we have used the census reports of 1890 as a basis, re-enforced by reports we have gathered in this office and our personal observation in our experience on the farm.

Average gross receipts from one cow as she is ordinarly kept in this State:

1	calf	$15.00
100	pounds of butter at 12 1-2 cents per lb	12.50
2,000	pounds of skim milk	2.50
	Total gross receipts	$30.00

Average gross receipts from one cow kept in a milk dairy, as shown by reports filed in this office:

1	calf one week old	$ 2.50
4,100	pounds of milk at average price	51.25
	Total gross receipts	$53.75

Average gross receipts from one cow kept in a butter dairy as shown by reports filed in this office:

1	calf one week old	$ 2.50
2,525	pounds of butter at 23 cts. per lb	58.08
5,000	pounds of skim milk	6.25
	Total gross receipts	$66.83

Average gross receipts from one cow as shown by reports from creameries:

1	calf raised on skim milk	$15.00
4,000	pounds of milk, skim milk returned	29.32
1,500	pounds of skim milk more than calf consumes	1.88
	Total gross receipts	$46.20

There is a considerable difference in the gross receipts as shown by the above tables. From what we get in the reports and from actual observation, we think the fairest comparison can be made with the creamery class. These cows are not

generally any better grade, neither do they receive any better care than class No. 1 but there is a differnce of $16.20 in favor of the creamery. The labor in making the 100 pounds of butter in class No. 1 will balance the labor of delivering the milk in class No. 4. With a little extra care and feed class No. 4 should produce at least $50. A cow can be well fed and pastured for twelve months under average conditions in Missouri for $25. This leaves $25 per head for the labor and profit, not counting the value of the manure returned to the land.

With good judgment in selecting and breeding up the herd, with careful attention to feeding and handling the cows, we are ready to answer "it will pay;" and in support of this answer we have the practical experience of several hundred farmers of this State and thousands of farmers of other States with like environments, to prove the correctness of our position.

BUILDINGS AND EQUIPMENTS.

One of the drawbacks to the development of the dairy industry in Missouri has been the work done by men traveling over the State and working up an interest and organizing a cooperative company and taking the contract to erect a building and put in a complete outfit, receiving two or three times what the plant should cost. We do not say that there is not a legitimate field for agents of creamery manufacturers, in promoting the dairy interests, but on account of the work that has been done in the past we advise our farmers that when they conclude to establish a creamery or cheese factory, to proceed with the same caution that they would in any other business transaction. The building can be erected by a resident contractor more cheaply than by a nonresident. You can secure net price lists from two or three manufacturers and with the assistance of the manager, who should be a practical

creamery man, you need not make the mistake that has been made by others, whether you make a contract for a complete plant or erect your building and furnish it under your own supervision.

From reports received from a number of the managers of creameries and cheese factories that are doing a satisfactory business in different parts of the State, we would say that a plant for making cheese only, having a capacity of 4,000 pounds of milk per day, can be erected for $800 to $1,000, which includes $500 to $600 as the cost of the building.

For a plant with a capacity of 6,000 to 10,000 pounds of milk per day, the building should be erected for $1,000 to $1,500 and equipped for about $500, making a total cost of $1,500 to $2,000.

From the same source we received the statement that a creamery plant of the capacity of 8,000 to 10,000 pounds of milk per day should be built and equipped for from $1,700 to $2,900.

One manager reports, "we contracted for our plant complete for $3,950 but we could build now and equip from any reliable Creamery Supply House for $1,000 less money."

Another says, "we paid $4,400, under contract, but could be put up now for $2,000." Another says, "a building should be put up for $700 and equipped for butter making for about $1,000, but ours cost in the first place $3,300, and much of the machinery was worthless."

We give below a list of articles for properly equipping a plant, and by sending to two or three different supply houses for a catalogue and net prices, an estimate can be made of the cost. Pulleys, shafting, belting, pipes, etc., are not given and the cost will depend upon the size and location of the building.

CHEESE FACTORIES FOR MAKING FULL CREAM CHEESE.

From 200 to 300 cows.

1 six-horse vertical Boiler, complete.
1 600-gallon steam heating Cheese Vat.
Add one additional 600-gallon Cheese Vat for each 200 Cows.
1 Curd Mill.
1 12-foot Curd Sink.
1 Cheese Press, 8 Gang Hoops, 14 1-2 inch.
1 400-lb. Platform Scale.
1 Salt Scale.
1 60-gallon Weigh Can.
1 Milk Conducting Head, 10 feet conductor pipe.
1 14-inch blade perpendicular Curd Knife.
1 6-inch horizontal Curd Knife.
1 flat sided Curd Pail.
1 Dipper, 1 gallon.
1 Curd Scoop.
1 Strainer.
1 Rubber Mop.
2 Thermometers.
1 20-bottle Babcock Tester.
1 Rennet Test.
1 Sink.

DAIRY OUTFIT.

50 Cows.

1 small Tread Power.
1 deepsetting Creaming Outfit.
1 30-gallon Cream Vat.
1 15 bottle Babcock Tester.
1 100-gallon Box Churn.

1 No. 2 Lever Butter Worker.
1 Salting Scale, 1-2 oz. to 240 pounds.
1 Gallon Dipper.
1 Buttermilk Strainer.
1 Butter Ladle.
2 Thermometers.
1 8-oz. Graduate for butter color.
1 Washing Sink.
1 Butter Printer.

SEPARATOR CREAMERY OUTFIT.

For 300 cows.

1 8-H. P. Engine.
1 10-H. P. horizontal Boiler.
1 factory size Cream Separator.
1 300-gallon Milk Receiving Vat.
1 300-gallon Cream Vat.
1 Milk Pump.
1 Sink.
1 Skim Milk Tank.
1 400-gallon Box Churn.
1 Power Worker, or
1 400-gallon combined Churn and Worker.
1 600-lb. Platform Scale.
1 Salt and Butter Scale.
1 60-gallon Weigh Can.
1 20-bottle Babcock Tester.
1 Milk Conductor Head.
6 feet Milk Conductor Pipe.
2 1-gallon Dippers.
2 Thermometers.
2 large Butter Ladles.
1 Butter Printer.

SEPARATOR CREAMERY OUTFIT.

600 cows.

1 10-H. P. Engine.
1 15-H. P. Horizontal boiler.
2 factory size Cream Separators.
1 400-gallon Milk Receiving Vat.
2 300-gallon Cream Vats.
1 400-gallon Box Churn.
1 Power Butter Worker, or
1 400-gallon combined Churn and Worker.
1 600-lb Platform Scale.
1 Salting Scale.
1 80-gallon Weigh Can.
1 Milk Conductor Head.
6 feet Milk Conductor Pipe.
1 30-bottle Babcock Tester.
2 1-gallon Dippers.
2 Rubber Mops, iron head.
1-2 dozen Thermometers.
2 large butter Ladles.
1 Milk Pump.
1 Milk Heater.
1 Sink.
1 Skim Milk Tank.
1 Butter Printer.

RAISING CALVES ON SKIM MILK.

The basis of all calculation for profitable dairying is calculated upon either selling the calves for veal or raising them upon skim milk. Notwithstanding this fact there are a great many people who do not believe that a good calf can be raised with the skim milk.

Prof. D. H. Otis, of Kansas, in an address delivered

before the Missouri State Dairymen's Association, said: "A dairyman's herd of skim milk calves is a very good index as to the character of the man. Experience of both the Experiment Stations and up-to-date dairy farmers shows that calves fed warm sweet skim milk, in clean buckets, with access to corn or Kaffir corn meal, bright hay, fresh clean water, salt, plenty of sunlight, shelter and bedding in cold weather, shade in summer, regularity, thoughtfulness and kindness in treatment, will usually be thrifty and gain from one and one-half pounds to two pounds daily. The dairyman who is unable to do this is behind the times and usually behind in his accounts. In other words he is a scrub dairyman."

The writer of this article has had good success in raising skim milk calves and this is how it was done.

Teaching the Calf to Drink.—I prefer to take the calf away as soon as born rather than be troubled with caring for sore teats of the cow. Use for convenience a shallow and broad metal pail, milking for a large calf three quarts, for a small calf about two quarts of milk. Then after gently caressing the calf, stroking the the neck or back with the hand, and talking kindly to it, place the milk under its nose and the fingers touching the lips but not in the mouth, soon it will begin to try to get hold of your fingers, then gently push its nose down into the milk and in its effort to get hold of your finger it will get a taste of the milk and is very apt to begin to drink. A little patience and kindness will meet with success. After it has been taught to drink you will find it much better to always place it in a stanchion at feeding time and let it remain there a short time after it gets through eating so that it will not form the habit of sucking the other calves' ears.

Time and Amount to Feed.—If you have an extra good calf and plenty of time, it may pay you to feed three times a day, but twice a day will answer very well; but by all means feed at regular hours. A large thrifty calf will

need about three quarts of milk at each feed on the start, if fed only twice a day; for a small one, perhaps two quarts will do. Always feed the milk warm, and feed whole milk until it will do to use, after which you may gradually change, taking off a little new milk each day, adding a little more skim milk until at the end of eighteen to twenty-one days you can have it on a full feed of skim milk. Watch it closely; if it scours reduce the feed, gradually raising it again when well. About this time if you will place a little dry meal or bran in the trough, or some bright hay or sheaf oats where it can get at it, it will soon learn to help itself. The milk can be increased gradually until at six weeks old it will take four quarts of milk at a feed. Don't feed any sour milk until the calf is eight or ten weeks old, after which it may be fed sour milk all the time, if more convenient, but I prefer sweet milk all the time. Let them have the run of a grass lot and regularly give a little salt and plenty of water.

Weaning.—There is no trouble about weaning the skim milk calves, for if you will gradually increase the grain and hay until five or six months old the milk can then be discontinued without disturbing the growth, and there is no need of a fence to keep it away from the cow.

Some Things to Do.—Give the calf a good warm and dry place, plenty of sunlight and exercise, feed regularly, measure every feed of milk. Keep the feed buckets clean, and remember that nothing is so cheap and will pay better profits than kindness and attention.

Some Things Not to Do.—Don't keep the calf in a muddy lot or stall; don't feed either cold or sour milk before the calf is eight or ten weeks old; don't feed one quart to-day and four to-morrow; don't be afraid to feed liberally dry meal or well soaked corn, dry bran or Kaffir corn meal, bright sheaf oats, cowpea hay or clover hay. Don't say you can not raise a good calf on skim milk, but try it and see.

PRIZES OFFERED TO STUDENTS IN THE SHORT WINTER COURSE IN AGRICULTURE.

To those showing the greatest proficiency in judging beef cattle and for the most creditable essay on the essential characteristics of a profitable beef steer, the State Board of Agriculture offered $40, first prize of $25 and second prize of $15, which was supplemented by a third prize of $5 offered by H. J. Waters, Dean of the Agricultural College:

First prize, $25, awarded to J. O. Erwin, Steedman, Mo.

Second prize, $15, awarded to R. L. Harbaugh, Liberty, Mo.

Third prize, $5, awarded to Earl F. Addy, Parnell, Mo.

To the students in dairying making the highest scoring butter with the least loss of butter fat, together with the best essay on the best method of making the same:

First prize, $25, awarded to R. R. Skipper, St. John, Mo.

Second prize, $15, awarded to J. M. Ballenger, McBaine, Mo.

Third prize, $5, awarded to D. T. Gates, Montrose, Mo.

Prizes offered by the Creamery Package Manufacturing Company of Kansas City, Mo., to the students in Dairying writing the most creditable essay on the "Adaptability of Missouri to Dairying:"

First prize, $30, awarded to E. R. Stoutemeyer, Onarga, Illinois.

Second prize, $15, awarded to J. E. Williams, Ebenezer, Mo.

Third prize, $5, awarded to Thos. Glendining, Hester, Mo.

We regret that owing to lack of space we can not publish all the essays.

First Prize Essay.

ADAPTABILITY OF MISSOURI TO DAIRYING.

By E. R. Stoutemeyer, Onarga, Illinois.

Normally Missouri is exceedingly well adapted to dairying. Nature has given her everything requisite to become one of the greatest dairy states in the Union. She not only possesses all of the natural advantages that the leading dairy states have, but has many in addition.

No dairy state has the climate for dairying that Missouri has. She does not have the cold winters that are experienced by the dairy states farther north, nor the sudden changes in temperature, which are so detrimental to the dairy cow. Yet it is cold enough, so that sufficient ice may be gotten for refrigerating purposes, nearly every winter.

Missouri's climate is very much like that to which the dairy cow has been accustomed in the Channel Islands, and naturally she is better adapted to this climate, than where it is colder. Our mild climate will permit the keeping of the dairy cow much cheaper than where she must be stabled and fed a much longer period each year. Take for instance Wisconsin, a successful dairy state; the dairyman there must incur much greater expense in providing shelter in the winter, and also compelled to feed his animals for a much longer period, which adds cost and labor and makes his product more expensive, than if produced in this State. Here the temperate climate will allow the cows to run on pasture nearly eight months of the year without grain, except in the latter part of the summer and in times of drouth.

If the cost of keeping dairy animals in some of the northern dairy states and in Missouri were compared, there would

be a good showing in favor of Missouri. Her soil is very rich, producing very abundantly crops of rich grains and grasses. Nearly all of the land is capable of being used for dairy purposes. Even her rough hills could be turned into dairy farms. This may hardly seem possible, but look at Switzerland, noted the world over for her butter and cheese, where the farms are very small, rocky and mountainous. Besides Missouri's fertile soil she is well supplied with wells, springs and streams of water.

Her timber supplies shade and cheap lumber for barns and sheds. No state in the Union can produce a greater variety or better quality of feed for dairy stock than Missouri, and a variety of feed is one of the essentials in dairying. By having a variety of food for the cow, and feeding so as to please her taste, the cow may be made to produce much more milk. As to the variety of foods, Missouri is especially noted for her grasses. Blue grass, timothy, and clover do especially well in nearly all parts of the state. Alfalfa can be grown on the dry uplands where other grasses do hardly so well. All kinds of grain and forage crops needed for dairying can be grown successfully in the state. Corn can be grown cheaper and better than in many of the dairy states farther north. The cowpea can not be grown in the northern dairy states as it is here.

Missouri also has the advantage over all the dairy states in the matter of obtaining her cotton seed and linseed meal cheaper than they, as a considerable quantity of both is produced within the State. Missouri can raise every food necessary for the dairy cow and can produce it much cheaper than any of the dairy states. Contrast her with New York. There all kinds of dairy foods are much higher than in this state. The dairyman there must pay several cents more per bushel for his corn than he does in Missouri. The price of pasturage, hay and all other feeds are also higher; thus enabling the Missouri dairyman to produce his dairy products much cheaper

than they can be produced elsewhere.

Nowhere can the dairyman find land so well adapted to his purpose at so low a cost as he can in Missouri. He does not need so much capital to buy him a farm and start in the business as where the land is high, as in some of the eastern dairy states. And as the soil is richer here than there, he will not need to pay out so much for fertilizers. Take New York again for example. Her people with their high priced lands have built up an immense dairy business and are carrying it on very profitably under less favorable circumstances; surely the people of Missouri, with their cheap land and fertile soil, temperate climate, good water supply, excellent pastures and large hay and grain crops, can by using some intelligence make dairying very profitable in this state.

There are decided advantages in dairying over general farming. It is a much easier way to pasture land that is hard to farm, and by keeping dairy cows, convert it into dairy products. Instead of the soil becoming exhausted after a time, as in general farming, it will be getting richer. Another advantage is that the income from the dairy herd will be coming in every week, while the stockman and the farmer must wait some time for the returns for his labor.

The dairy cow is a much more economical animal than the beef steer. Some make the claim that she will produce a pound of butter as cheaply as the steer will a pound of beef. Even if this were hardly true there is no question but that she will make more than double the profit that the beef steer will on the same amount of feed. It will be readily seen that dairying will give more and better returns than any other branch of farming in which a person can engage.

The beauty of dairying is that a person with a small herd can produce just as good products as one with a larger one. To make dairying a success there must be a market for the dairy products. No matter how well the country may be adapted

naturally, if no market is available, dairying can not be made profitable.

It can not be said that Missouri has no market. On the west is Kansas City with a splendid market and on the east St. Louis, with her large manufacturing population, who are large consumers of these products. Besides these two large markets there are a great many smaller cities well distributed over the state, making good local markets. There is also a market for her products in the west and southwest, and being closer than the dairy states, she could easily compete with them. If these markets are not satisfactory she is not far from Chicago, the largest distributing center in the west.

It is said that Missouri only produces about one-half of the butter she consumes, the remainder being shipped in from our sister states. Surely if they can produce these products and send them to our markets and make a profit, the home dairyman can make a much greater one.

There is very little danger of over-supply, as good butter will always make a market for itself. If only good butter could be put on the market, the consumption would nearly double in a single year. It is only the poor article which can not find a good market.

As for transportation Missouri is well supplied with railroads; being well distributed throughout the state, with only few exceptions. Her rivers also supply cheap transportation, having about twelve hundred miles of navigable waters.

Missouri has an advantage in her location over many states. She is nearly centrally situated in the United States; being so she can ship her products in all directions to good advantage.

Iowa is the greatest butter producing state in the Union. She has seven hundred and eighty creameries, only two counties in the state being without them, which produce about one-

tenth of the butter made in the United States. Iowa has no natural advantage which Missouri does not have, but is lacking in some that this state possesses. Iowa has a less temperate climate and does not have the timber and can not raise quite as great variety of dairy foods as can Missouri.

We have seen how Missouri is naturally better adapted to dairying than many of the leading dairy states. The question will then arise: "Why is she not in the lead as a dairy state?" One of the main reasons is, that the average Missouri farmer does not take readily to dairying, and is averse to changing from the occupation in which he was engaged, before there were so many railroads through the state. Then they made the most of the money by feeding stock, as it could be driven a long distance to market.

Another is the ignorance of the subject of dairying on the part of the farmer. He may have a good knowledge of caring for beef cattle, yet not know anything about the management of the dairy animals.

The reason so many farmers who have tried dairying in this state, have failed, is because they are ignorant of any systematic methods of dairying, and after trying it for a short time in a careless manner decide that it does not pay and quit the business.

There are very few instances where there has been a failure in dairying where knowledge and skill have been applied, as in the leading dairy states. Where the leading dairymen of Missouri have exhibited their products in competition with those of other states, they have often carried off the honors, thereby proving that Missouri can not be surpassed in quality of products produced by any of the leading dairy states.

We must conclude then that many of the farmers at present are not adapted to dairying; but as the population of the state is increasing very rapidly there will be more of a tendency toward smaller farms, and more interest will probably

be taken in dairying. No doubt dairymen from other states will see the great possibilities, and will come to this state to engage in this industry.

As to the number of cows, Missouri is fairly well supplied, having a greater number than some of the dairy states. She has some very good herds of dairy cattle and if the dairy industry were developed would within a short time have a large number of fine dairy herds, as they could be brought in from some of the neighboring states, or with the number of cows that are here now we could in a short time build up good dairy herds.

Suppose for the moment that Missouri were a leading dairy state and see what the condition of the state would be.

There would be a more intelligent class of farmers, as to be a successful dairyman a person must use a considerable degree of intelligence. There would be smaller and better farms and more of them, more and better farm buildings, closer neighbors in the country, better schools and churches and better roads over which to haul the dairyman's products to market.

No doubt before long when the state becomes thicker settled and the people begin to realize the natural resources of the state for dairying, there will be a marked advancement in this profitable branch of farming throughout the state and then Missouri can truly be classed as one of the leading dairy states.

Part III.

DAIRY SCIENCE; BUTTERMAKING.

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RECENT DEVELOPMENTS OF SCIENCE IN DAIRYING.

The practice of dairying dates back to the remotest antiquity. For thousands of years succeeding generations of men have to a greater or less extent utilized the product of the cow for nourishment and sustenance. In the earliest stages of this industry the methods were of course crude and blundering, but knowledge gradually progressed through experience until certain well established methods began to form the art of dairying. This was wholly an empirical art, differing in many details of practice among different regions—handed down from father to son or from neighbor to neighbor in unsystematic and incomplete form, which prevented any improvement. The facts in regard to results were learned by observation, but the reasons were frequently shrouded in mystery. The appliances used were few and often entirely unsuited to the work. Consequently the products were variable and of inferior quality.

Modern science has completely changed this state of affairs. During the past thirty years the art of scientific dairying has made greater progress than any other farm industry. Within this time many inventions and discoveries have been made which have entirely revolutionized the business, until to-day it is no longer controlled by arbitrary rules, but stands upon a firm foundation of scientific fact and expert

practice. Patient investigation has brought out the true reasons for the various operations, and the dairyman can now be guided by general principles which are broad enough to meet the requirements of all exigencies of the trade.

Perhaps the greatest stimulus has been given to this new industry through the invention of mechanical appliances for carrying out the work on a large scale, with a minimum of expense and loss. The greatest forward stride in the history of dairying was inaugurated by the invention, about 1875, of cream separators. These machines utilized centrifugal force at a high rate of speed for the separation of cream from milk, and were so far in advance of previous methods in this line that they have been almost universally adopted. Through their use alone has the development of modern dairy manufacturing methods been made possible, by reason of the immense saving of former losses, and the ability to handle large quantities of the raw material.

About the same time the "deep setting" system of creaming also came into use for the first time. By this method the milk is set in deep cans surrounded by cold water; it has been of great use on farms and in home dairy work, and is so far in advance of the old method of setting in shallow pans that it has almost entirely superseded former methods. But the losses are still so great by this system during a year, that the use of small sized separators at the farm is increasing rapidly at the present time; and the separator system is destined, on account of reducing losses to the absolute minimum, to come into use in every dairy district.

In the new dairying the sciences of chemistry and bacteriology also play an important part. During the nineteenth century the chemist has made plain all the facts concerning the composition of milk and its products which are so essential to a proper understanding of dairy management. Old ideas and vague theories have been exploded, to be replaced with

more tangible certainties. The laws underlying the nutrition of animals and the proper feeding of the dairy cow for the production of milk and butter are of comparatively recent origin. Exact chemical tests have been devised which will show at any time just how much acid milk contains, and when it is ready for churning.

Owing to the fact that the amount of butter fat which milk contains determines its commercial value, the need for some rapid, accurate and inexpensive test for fat became more and more apparent during the last half of the century. Many tests were devised for this purpose, some of them reaching very near the desired ideal; but it remained for Dr. S. M. Babcock, of the Wisconsin Experiment Station, to place before the public in 1890 a method of testing milk which in a short time made his name famous, and was adopted over the entire world. The Babcock test for fat has done more to make dairying an exact science than any other chemical test. By its use creameries and cheese factories are able to settle all differences in the equitable payment of their patrons who furnish milk, and the farmer himself now has at his command the means of knowing whether his cattle produce a profit or are kept at a loss.

And now within the last ten years bacteriology, the youngest of these sciences, has shed much light on problems which have heretofore puzzled the deepest minds. The present knowledge of these minute forms of life which abound through all nature has explained the fermentations and changes which occur in milk, and has led to greater care and cleanliness in their control.

The modern dairyman must acquaint himself with these elementary facts of science which relate directly to his work. He can not afford to be without the help which this knowledge affords. He should be able by their aid to recognize and control all the difficulties of the profession; he should acquire and

retain the mastery over all these agencies which when properly understood become his servants, but if overlooked will work his ruin.

For a long time there were no schools for proper training and instruction in dairy methods, but during the close of the last century this demand has been reasonably well satisfied. There are now a number of excellent schools in the United States offering practical work in these lines. Such schools, properly conducted, are an immense help in the advancement of dairy knowledge, and they have become a highly important factor in the development of this industry in our nation.

Through the help of the recent appropriation of $40,000 given by the last State Legislature, Missouri will soon have at the Agricultural College a dairy building which will be equal if not superior to any on the American continent. If it is possible to get the work done, this new building will be ready for work by January 1, 1902, when regular courses will be offered in Creamery Management, Cheese Making, Farm Dairying, and all the sciences and practical work relating thereto. This will be a splendid opportunity for the young men of Missouri to perfect themselves in a business which is destined to increase largely with the advancing prosperity of our great state.

The Legislature also passed a law establishing a chair of Dairy Husbandry at the Agricultural College, appropriating $5,000 for salary and traveling expenses. It is proposed to secure the best teacher in the country for this work, and also have him travel through the State wherever he is needed to help put the dairy industry on a good footing. The State Board of Agriculture has also taken up the matter of encouraging this industry more largely than ever, and will give much attention to it through the medium of farmers' institutes, conventions and dairy meetings.

With the superior resources at her command there is no

reason why Missouri should not rank with Iowa, Minnesota and other leading dairy states. And with all the above mentioned influences to aid in this direction, if the farmer will only do his share toward helping and becoming interested in the work, Missouri will in a short time stand at the front in dairying, as she already does in fruit raising and beef production.

ADVANTAGES OF THE DAIRY INDUSTRY TO THE STATE.

Dairying is the safest and most abiding of all agricultural industries. During times when prices for all other farm products were falling or fluctuating, the price of dairy products has remained firm or slightly increased. The average price of butter through the summer and winter has remained more nearly the same for the past twenty years than any other food commodity. The demand for these products is increasing every year, much faster than the supply, and the price is constantly rising. As the population of our country becomes more dense, this demand will in all probability increase more and more; the average consumption per capita is now greater than it was ten years ago.

As land becomes more costly, dairying will come more and more into prominence as a form of intensive farming. The dairy cow is one of the most profitable animals on the farm. She utilizes most of her feed for producing milk, instead of storing it in the form of flesh. She is therefore an economical producer. She will produce twenty to thirty pounds of milk per day containing perhaps a pound of butter fat, or three pounds of cheese, on the same amount of food that a beef steer will require to lay on two to three pounds of fat per day. She will continue this work for years, while we may say the beef steer must be sold off and renewed several times during this period, as it becomes less and less profitable to continue feeding

him as age advances. In the future of agriculture, the beef steer is certain to decline first, because he is not an economical animal, while the dairy cow is becoming more and more profitable with each generation.

Dairy farming preserves and builds up the fertility of the land better than any other system. The farmer is able to use all his rough land, and can feed to his own animals all the grain and fodder the land will produce. In this way he secures a higher price for his crops, and retains their fertilizing ingredients on his farm in the manure.

As a specific example of the prosperity dairying will bring, we can do no better than to quote the words of Ex-Governor Hoard of Wisconsin, in speaking of his home locality, Jefferson county, Wisconsin:

"This county is twenty-four miles square, and has a population of about 40,000 people. In 1870 its agriculture had reached its lowest ebb. Farmers had engaged in wheat raising until they had so reduced the native fertility of their land that the average crop of wheat was only eight bushels per acre. The farms were heavily mortgaged to the extent of sixty per cent of their assessed valuation, and their average value was $20 per acre.

"At this time the farmers of the county were induced to take up dairying, and the improvement soon became apparent. To-day it is in many respects the wealthiest county, agriculturally speaking, in the state. There is scarcely a farmer who is not a dairyman. It has met Holland's boast, and has a cow to every inhabitant. Its cows earn annually nearly two millions of dollars. It has nearly one hundred creameries, making over 7,000,000 pounds of butter annually. Its dairy farmers carry on deposit in the banks nearly two millions of dollars. The average price at which all farm lands sold last year, according to the records of deeds, was $61 per acre. In truth it was nearer $80 per acre. The cash value of the entire

agricultural product of the county, by the state census of 1895, was $4,300,000. The county is covered with splendid herds of high-grade cattle, and fine barns greet the eye in every direction. The fertility of the land has increased to such an extent that the average yield of wheat now is twenty-one bushels per acre. The land produces larger crops than it did in its virgin condition. And Jefferson county is but a type of every county in the United States that is devoted to dairying. There were no failures in the dairy districts during the hard times of 1893 and 1896."

The greatest argument in favor of dairying is found in the fact that the products command a ready sale for cash, and brings into circulation and in the farmer's hands a larger amount of money than other systems of farming. It is estimated that there are 6,000,000 farmers in the United States who are more or less directly interested in dairy farming. The value of their annual product in milk, butter and cheese is fully $700,000,000. The annual earnings of the cows of the State of Wisconsin alone reach $35,000,000. In New York state nearly 300,000 persons are engaged in the dairy industry. Iowa has 1,000 creameries with 75,000 patrons. The creameries of Illinois have 100,000 patrons. Minnesota has 800 creameries and cheese factories, with 50,000 farmers as patrons.

The next greatest influence of dairy farming is in raising the standard of intelligence of the people, and the material prosperity of the community. When once a farmer's attention is aroused in intelligent dairying and stock raising, he will have better buildings on his farm, better fences, better methods of feeding, better breeding, and a better mode of life for himself and family. The dairy farmer, in order to keep pace with modern methods, must be progressive and keep wide awake. New ideas call for constant improvement, and improvement demands higher thought and intelligence. Every

creamery and cheese factory is a dairy center, acting as a school for the promotion of best thought on all agricultural questions. The dairy industry is one of the best organized branches of agriculture. Nearly every State has a dairy association which holds annual conventions, and through the officers is able to create the proper sentiment, or promote state legislation for the protection of the industry.

There is no community so thrifty, so well satisfied, so prosperous, as one devoted to dairying. The history of the industry in other states will show beyond question what can be done in this line. For example, in Minnesota ten years ago the farmers were all raising wheat, and the state was not at all recognized as a dairy section. Very little of her butter was sold as Minnesota butter; what few creameries they had shipped their butter to Elgin, and sold it through the markets as Elgin butter. To-day Minnesota butter has a national reputation, the dairy industry has increased enormously, and the prosperity of the State is far in advance of what it was under the old regime.

The total value of the investments of the State which are devoted exclusively to dairying, including the farm lands, cattle and fixtures, as well as the factories; and the annual income from these sources, including cash receipts, skim milk and calves, has been calculated by Prof. Haecker as follows:

	Value, including lands, cattle and factory plant.	Annual Receipts, gross.
Creameries, 720	$85,860,000	$19,600,000
Farm Dairies	80,075,000	15,100,000
Cheese Factories, 50	3,725,000	475,000
Total	$169,660,000	$35,175,000

While this table does not show the expenses of carrying on the business, yet it gives some idea of the immense amount

of money which is put in circulation by the industry. The dairy farmer is one of the best customers of the manufacturer and merchant. He must have the most improved labor-saving machines for growing his crops, in order to care properly for his cows. In fact, the dairymen are the cream of the farmers of America, and are by force of character and general intelligence the leaders in their communities. They are the men who set the pace, other farmers follow. The business man who gets them for customers soon gets all the desirable custom in that community.

COMPARISON OF THE ADVANTAGES OF CREAMERIES, SKIMMING STATIONS, AND FARM DAIRIES.

The first creamery in the United States was built in 1864; the first cheese factory in 1851. Since that time the business of associated dairying, or the treatment of the milk from several patrons in one plant, has developed enormously. There are now about 10,000 creameries in this country, producing annually over 300,000,000 pounds of butter—about one-fifth of the total product. The remaining four-fifths of the butter is made on individual farms and in private homes.

As the creamery system has advanced, varying conditions have brought about modifications of the service, until to-day there are three distinct forms of factories in operation. First, the creamery proper, or separator butter factory, where the whole milk is separated and made into butter in the same building and under the supervision of the same person. Second, the gathered cream butter factory, where the patrons perform the work of creaming at their own homes, and send only the cream to the factory, where it is made into butter. Third, the most recent and modern system is found in the establishment of small separator stations where the whole milk is

skimmed, and the cream sent to some central plant to be made into butter along with the product of many other such stations.

It becomes therefore a matter of great importance to a dairy community, or one about to engage in dairying, to decide which of these systems should be inaugurated. There are advantages and disadvantages in all of these systems. Each is adapted to certain conditions, and is likely to encounter many difficulties under unfavorable conditions, where another form of the industry would be more successful. The choice between them must therefore depend entirely upon local conditions, and the wish of the community with reference to their share of the work to be accomplished. We shall attempt in this article to set forth the advantages to the farmer of each of these systems.

THE CREAMERY.

The creamery system is one that requires the farmer to haul his milk daily to the factory, where he receives a stated price for the same, and is relieved of all responsibility so far as making and marketing the butter is concerned. As this is the pioneer system, some of the arguments which are given here favoring the creamery as compared with the work of farm dairying will apply equally as well to any of the above forms of associated dairy work.

As a general rule the creamery will produce more butter from the same milk, with less waste in manufacturing, through the use of improved machinery for the purpose. It will generally produce butter of a better quality, which will bring a higher price on the market. The product is more uniform from day to day in flavor, color, packing, etc., as it is made by the same operators, and under the same conditions.

The creamery cheapens the cost of manufacturing by concentrating the work all in one place. The milk product of one hundred farms may easily be utilized by one outfit of ma-

chinery, while if each of these farms should attempt to do all the work it would require the expense of one hundred complete small outfits for making butter.

The creamery system brings the farmer a monthly cash income without any trouble on his part in collecting sales from customers. It saves the farmer the time required for marketing his butter.

After delivering his milk to the creamery, the farmer will still have sufficient time to do at least half a day's work on his farm. He will therefore be able to keep and manage a larger number of cows in his herd than when making his own butter.

The practice of dairy farming enables the farmer to utilize all the grain and roughness he is able to raise on his farm in feeding the same to his cows and turning out a finished product—milk. He also receives at the creamery his proper share of the skim-milk, which is utilized on the farm for feeding calves and hogs. These two items effect a great saving of the fertility of the soil, permitting no waste, and allowing none of the costly fertilizing materials to be sold off the farm.

Another important item is that by this system a large amount of the drudgery of dairy work, such as the cleaning and washing of utensils, and oftentimes the entire labor of making the butter, is taken from the women of the household. This may seem like a small matter, but it is often a serious burden for the overworked farmer's wife to attend to such matters in addition to numerous other duties; and it is too true that a larger share of such work than they deserve or are able to bear is heaped upon the women of the farm.

The creamery system is most effective when a sufficient number of farmers supplying the milk are all located within a radius of five or six miles from the factory.

THE CREAM GATHERING BUTTER FACTORY.

Under this system the cream is separated upon the farm, usually by the deep cold setting process, and the cream only sent to the butter factory. The great advantage of this system is in saving the cost of hauling, especially when the patrons are widely scattered. But this method has many serious drawbacks. No two farmers will give cream the same treatment, and the factory is therefore unable to turn out butter of high or uniform quality. The butter from these factories usually sells for two to three cents per pound less money on the market than the regular creamery product. The cream is delivered only every other day, sometimes only twice a week, and is often kept under bad conditions, so that it reaches the factory in as many different stages of sourness as there are patrons. Until the farmer learns more about handling cream and begins the use of hand separators on the farm, this form of dairying can not be recommended.

SKIMMING STATIONS.

Within the past ten years large numbers of small factories have been established, where the milk of the community is all separated by one large power machine, and the cream sent usually by railroad to some large central plant where it is made into butter and put on the market. The skimming station requires much less expense for the building and equipment than a complete creamery, and the operating expense is also less, since but half the work is done there. The cost of transporting the cream is more than compensated for by the higher price which can be secured for the butter when it is made in one central plant, under one management, with the most skillful buttermakers that money can hire, and the best facilities for disposing of the product in the large markets. This centralized form of business is able to cover a wide territory, and on account of reduction in expenses is able to pay

as high prices for milk as the creamery. This system also entrusts each stage of the work to experienced men. It is one matter to make good butter, but quite a different matter to market it to advantage. A creamery operator may be a good butter-maker, and yet be a complete failure in selling his butter for the best prices. When the marketing is done by men skilled in handling butter by the carload, the results are much better.

The skimming station is eminently adapted to communities where the dairy industry is yet in its infancy, or where the milk supply is not large enough to support a creamery. The skimming station is a good beginning, and is certainly a profitable investment for any community, and is an ideal plan for our State, considering the present state of the dairy industry in Missouri.

As the industry advances, and the farmers become more interested, the establishment of creameries should follow in every dairy community.

Those states have made the greatest progress which begin the industry by establishing creameries wherever possible. The creamery is the pioneer, as it requires an expert manager, who becomes a center of information in regard to the production and care of milk, and the making of butter. It is only after learning thoroughly the lessons which a creamery patron should know that a community is able to begin the work of private dairying on a large and profitable scale.

FARM DAIRYING.

When we consider the fact that nearly four-fifths of the butter made in the United States is made by individual families, this subject becomes one of the greatest importance. The sad truth must be recorded that a great deal of this butter making on the farm is carried on in a haphazard way, sometimes merely because the cow insists on giving the milk. The

milk receives little care or attention, and the butter is made by slovenly methods. The product of course sells all the way from two-thirds to one-half the price which good butter brings.

Any influence, therefore, which can be brought to bear upon the farm homes that will raise the quality of this butter product would be a source of great benefit to the farmer. The writer desires to go on record as favoring anything which tends to uplift this great mass of farm butter makers to higher ideals and better methods. There is no reason why the dairy part of farm work should not be made twice as profitable as it is at the present time.

It is an undisputed fact that there is more profit in private dairying, rightly conducted, than any other farm industry. This demands the use of faultless methods, however, as well as building up and holding a private home trade for the products. The milk supply of cities and large towns offers an easy and exceedingly profitable method of disposal of fresh milk. In thickly settled communities where there is no butter factory, a regular trade for fancy butter can be established at prices reaching often as high as twenty-five cents per pound throughout the year.

The profits in this line of dairying rest entirely with the farmer himself, depending on whether or not he will take the pains to turn out a superior product every day in the year. Good butter is good butter the world over, no matter where made, and if put on the market it will sell every time for exactly what it is worth. If it is made so as to produce a uniformly fancy article, it will bring a fancy price.

In order, however, to equal the price received for creamery butter, the farmer must equal or excel creamery methods. He must understand the business in every detail, must study diligently, and exercise constant care and vigilance in his methods. If dairy operations reach sufficient size, and a good market is secured, the farmer may as well do the work of butter

making on his farm, and save for his own income the two or three cents per pound which the creamery would charge for turning his milk into butter.

Even in making butter in a small way, there is no reason why he should not secure a reasonable price for his butter, say eighteen or twenty cents per pound, if he will make his product worth that price, instead of securing only ten or twelve cents in trade at the grocery for it, on account of bad methods. It is no more trouble and work to take proper care of the milk and produce good butter than to use careless methods and produce at a loss "something" which is the despair of the merchant and commission man, and is fit only to be thrown into barrels and sold for grease. The farmer must depart from some of the traditions of his grandfather and grandmother if any progress is ever attained in this direction. It is to be hoped that he may see it will be to his advantage to avail himself of the information which stands waiting for him, and remove from the farm the stigma of this disgrace.

Any farmer who is unwilling to believe that *his* butter is not up to standard can easily settle the matter for himself by sending a small package of his product to any reliable butter commission house in the cities. Most of these firms will cheerfully examine the butter, score it according to its merits, and point out to the maker exactly where the defects in his methods may be remedied.

THE PRODUCTION AND CARE OF MILK.

The art of dairying is based on the maternity of the cow. She produces milk primarily to nurture her young, and man has encouraged and stimulated this function until to-day it forms the chief work of millions of cows. The greatest milk production requires liberal feeding of the proper kind, and the

selection of animals with milking tendencies. As these phases of the subject are treated in the later articles of this Bulletin, we need not dwell upon them here. Since the cow has become a mere machine for the consuming of food and converting it into milk, it is essential in securing the most returns to have good cows. A good cow is a good cow the world over, whatever breed she may be. No animal should be kept for milking purposes that does not produce 200 pounds of butter fat per year or more. The expenses of feeding and caring for the animal will barely be met by the production of 150 to 175 pounds of butter fat per year; the profit is therefore found in the production above expenses. A cow yielding 250 pounds per year gives a fair profit, but a 300 pound cow gives more than twice as much net profit. The ordinary yield of milk should be 5,000 or 6,000 pounds per year, or something over 400 gallons. Some of the best cows produce as high as 8,000 to 10,000 pounds of milk per year, containing 400 to 500 pounds of butter fat. In order to know which are the good cows, it is absolutely necessary to employ some method of determining production, such as the Babcock test, and weighing or measuring the milk.

The profits in dairying are also greatly influenced by the season of the year. It should be the aim of the dairyman to produce the largest quantity of his commodities during the time when they will command the highest prices. For this reason, winter dairying is much more profitable than summer work. If the calves are allowed to drop in the spring, it is true large amounts of milk can be produced on cheap summer pasture, but at this time milk sells at the lowest price; the heat, drouth and flies are troublesome; the farmer is busy with his crops and harvest; and the care of the milk and making of butter is much more difficult than during the winter. Cows that freshen in the spring must be put on dry food during the winter, and the change usually produces a marked decrease in the

milk flow, or even causes the animal to go dry entirely. The cow must be fed a reasonable allowance during the winter to keep her in reasonable condition, and she often gives absolutely no returns for this food. The young calf in early winter is also compelled to begin dry feeds immediately after weaning.

On the other hand, the advantages of winter dairying are numerous. If the cow drops her calf in the fall or early winter, she will give a good flow of milk throughout most of the winter season on very little more feed than is necessary to winter a dry cow. In the spring, when the milk flow has begun to decrease, the cow seems to take a new start when put on grass, thus giving practically two freshenings in the year. By this method of dairying, the greatest milk yield occurs during the season of highest prices. The farmer is not so rushed with work, and can give more attention to feeding and caring for the cattle. In the mild winter climate of Missouri, it is not necessary to provide the very best shelter, except during very small parts of the season. The manure produced in stabling will easily repay for the extra care and trouble. It is much easier to care for the milk and produce good butter when the temperature is cool, and there is a great saving in ice.

After securing the best cow possible, and having fed her in the best and most economical manner known, the next step is to take proper care of the milk. The value of milk depends largely on the care it receives, as well as the amount of fat which it contains. Every dairyman knows that the method of handling the milk within a few hours after it is drawn has a great influence on its quality and the quality of the products made from it. One batch of impure milk delivered to a creamery or cheese factory will easily spoil the entire product for that day, and work a great injustice to the other patrons. On a large proportion of dairy farms many of the fundamental principles which should be observed in producing pure milk are entirely overlooked. The farmer must understand something of

the changes which take place in milk after it is drawn and the conditions which affect its purity, in order to improve these conditions.

Bacteria.—The changes which occur in milk, such as souring, are caused by minute vegetable germs or micro-organisms called bacteria. These little germs consist of single living cells of different shapes and sizes, and are so small that they can be seen only by the aid of a microscope—several million being able to collect in one drop of milk or water. Under favorable conditions, these germs multiply very rapidly, one parent germ being able to increase in a few hours to hundreds of thousands.

Conditions of Growth.—The conditions essential for their growth are, first, food—organic or animal matter of some kind; second, heat, the best temperatures for their growth being between 80 degrees and 100 degrees. At a temperature of 90 degrees they grow most rapidly. Third, bacteria require moisture, and thrive best in weak light.

The chief agents therefore which may be used to combat bacteria are the opposites of these, viz.: lack of food, low or high temperatures, dryness and plenty of strong sunlight. Most bacteria are unable to grow at temperatures near 50 degrees or below, and nearly all of them are killed by temperatures as high as 150 degrees.

Distribution.—Bacteria are enormously abundant through all nature—in the air, the soil, dust, water, and especially in animal matter and the manure and litter of a stable and barnyard. Milk is eminently adapted to the growth of bacteria on account of the food material which it contains, its warmth and liquid condition, and here these germs find a very paradise and soon increase to immense numbers.

Kinds of Bacteria in Milk.—Something over 200 kinds of bacteria have been found in milk. The farmer should not gain the impression, however, that all of these species are in-

jurious; some of them are very beneficial, and in fact quite necessary in dairy practice. Others produce undesirable changes, and are very harmful. Some are practically neutral, producing neither benefit nor injury. If it were not for the beneficial bacteria, for example, those which produce ripeness or sourness in cream and flavor in butter, our present methods of dairying would be impossible. But we must keep even these under control, and must avoid or destroy the harmful germs, especially any which carry such diseases as tuberculosis, cholera, typhoid fever, etc.

The care of milk on the farm resolves itself then largely into a question of how to avoid and suppress bacteria.

How Bacteria get into Milk.—The principal methods are, dirt from the animal or stable; unclean dairy utensils and methods of milking; the fore milk or first milk; general atmospheric conditions.

The largest quantities of germs get into the milk during the process of milking or during the short time after it is drawn from the cow until it leaves the stable. This may be said to be the critical stage. All the particles of skin, hair, dirt or manure which fall from the body of the cow carry germs; the manure-laden air of the stable carries thousands of them into the milk every moment it is exposed.

Dirty or improper dairy utensils are the next greatest source of contamination. The dirt may not be prominent, but is always present in open cracks, seams, or joints of the pails and cans. Unless cleaned with special care, such places soon become filled with foul and decomposing scum containing bacteria in millions. A rusty spot on the tin often spoils with its germs more milk than a new vessel would cost. All the joints and seams of utensils, both inside and out, should be filled evenly with solder, to avoid lodging places for filth and germs. Wooden pails are no longer tolerated in dairy work, as it is almost impossible to keep them clean.

Untidiness of milkers is another danger which should be inexcusable. On some farms milking seems to be regarded as dirty work, and the milkers prepare for it accordingly; they will brush the horses and clean the stable a while, then proceed to milk in the same apparel. Dust falls from the shoulders and sleeves into the milk, and the hands and finger nails of the milker often help produce dirt.

The fore milk, or first stream from each teat, contains large numbers of bacteria which force their way through the opening into the milk cistern between milkings.

How to Keep Milk Pure.—The first requisite for pure milk is of course healthy cows. Any cow that is sick or diseased should be separated from the rest of the herd and her milk rejected. The milk for twenty days before calving and four or five days afterwards should not be used for market. Given healthy cows, the next most important step is to keep the animals themselves clean. If necessary, the cow should be curried or brushed every day. She should be bedded and housed in such a way as to keep clean. Above all, the stable should be kept clean, well lighted and well ventilated. Strong smelling manure should be removed as quickly as possible, and the dust caused by fodder or litter should be avoided, especially at milking time.

The milkers should be clean and healthy in every respect. It is best to milk with dry hands; the practice of milking with hands in a sloppy condition from water or milk is disgusting. The udder and surrounding parts should be brushed just before milking, and perhaps wiped with a sponge or damp cloth. If it is necessary to wash off dirt or manure, the parts should be dried.

Feeding and milking should be performed at exactly the same hours every day. Cattle are creatures of habit and are much disturbed by any irregularities in their daily routine. Never give strong flavored foods, such as cabbage, turnips,

etc., while milking, as the taints will appear in the milk. Never stir dusty hay, fodder or bedding while milking. Throw away the first two or three streams from each teat, as this milk contains many bacteria and is so watery and poor in fat that the loss is insignificant.

Care after Milking.—Do not allow the milk to remain in the stable after being drawn, but remove each pailful as soon as possible to a place where the air is quiet and pure, and strain at once through either fine wire gauze or several thicknesses of clean cloth.

Milk should also be thoroughly aired immediately after straining, to allow the animal odors to escape. This can be done in several ways, depending upon the future disposition of the milk. If the separator can be used while the milk is warm, this process will do a large part of the aerating. If the deep setting system is used, the milk should be set in cans and surrounded by ice cold water within a few minutes from the cow, and the covers arranged to allow the escape of gas and animal odor. If the milk is to be used for city markets, or sent to a creamery, it should be aerated thoroughly, and cooled as rapidly as convenient to 60 degrees or below. Never close covers tightly on a can of warm milk. There are several forms of apparatus for aerating milk. Any method that will separate the liquid into thin streams and allow all parts to reach the air, will answer this purpose. A pan with small openings in the bottom, supported 18 or 20 inches above the milk can is both cheap and efficient. Pouring the milk slowly several times from one vessel to another will help. The surrounding air should be perfectly pure, fresh and cool during this process. In order to keep milk or separated cream fresh for any length of time, the temperature must be reduced from the natural heat of the cow's body down to 60 degrees or even 50 degrees as rapidly as possible by all known aids. As has been stated before, the best temperature for the growth of bacteria is be-

tween 80 degrees and 100 degrees, and it is important to pass through and get below this critical stage promptly, or the germs will begin to develop. Milk that is allowed to cool slowly and naturally from 90 degrees down to 60 degrees, requiring two or three hours time, will contain at that time many thousands of germs, in comparison with only a few hundred in milk that is quickly cooled through these ranges of temperature. At temperatures of 50 degrees and below, most of the bacteria are unable to grow, and milk can be held thus for two or three days without material change.

It is best to keep the night and morning milkings separate; at least warm milk should never be mixed with cold milk; it should first be cooled down to near the same temperature. Under no circumstances should any preservatives or powders be added to milk to keep it from souring. These are criminal makeshifts of dirty dairymen. Cleanliness and cold are the only preventives needed.

The Utensils.—Vessels which have held milk should be cleaned by first rinsing with lukewarm water. Then wash with hot water, using a brush or cloth. Finally they should be sterilized either with live steam or boiling water, to kill all germ life. If possible, leave utensils to air in bright sunlight for awhile. If scalding water is put first into milky vessels, it cooks the milk on to the sides, and in the end requires twice as much work in cleaning as the above method.

The practice of hauling back skim milk and whey from factories in the same cans that are used for milk is objectionable. If this can not be avoided, the cans should be emptied at once on reaching home, and thoroughly cleaned and sterilized.

MANUFACTURING AND MARKETING FARM BUTTER.

When good clean milk has been secured, the next steps concerned in the making of butter are to separate the cream from the body of the milk, ripen it, and churn out the butter.

There are two recognized methods of securing the cream —by the deep cold setting system, and by the use of cream separators.

The deep setting system depends for its action upon the force of gravity. In fresh milk the globules of butter fat are scattered through the mass in a finely divided state, or emulsion. The butter fat is lighter than the watery portion or serum of the milk, and if the milk is allowed to remain at rest for any length of time, these globules will rise slowly to the surface and collect in the form of cream. The efficiency of the deep setting system is therefore dependent upon two main conditions—the size of the fat globules, and the resistance offered by the watery portions of the milk. If the milk contains a greater proportion of large fat globules, they will rise more easily and quickly, while if the fat is finely divided into small globules, large numbers of them will fail to reach the surface and are lost in the skim milk.

If the milk serum becomes heavier or more viscous, it will greatly retard the movement of the fat globules. When cows are fresh in milk, the fat globules are large, and gravity creaming is much easier and more effective; but as the period of lactation advances the globules decrease in size, and much more fat is lost by this process.

According to Dr. Babcock, of the Wisconsin Experiment Station, milk contains a small amount of fibrin, similar to the fibrin found in the blood, which if allowed to remain at temperatures between 60 degrees and 80 degrees will in a very short time form an invisible network or clot throughout the milk, holding many of the fat globules in its meshes and pre-

venting them from rising to the surface. On the other hand —just as with blood—if the milk is cooled quickly to a temperature of 50 degrees or below, the formation of fibrin is prevented by the cold. The milk serum also cools more rapidly than the fat, becomes relatively heavier, and thus aids the fat to rise.

For these reasons, the most important part of the deep setting system is to set the milk in the deep cans in cold water within a very few minutes after it is drawn from the cow. Ice water is the best for this purpose, as it cools it more quickly. The temperature of the water should remain constantly as low as 50 degrees, and 45 degrees is better. It has been found in comparing temperatures of 45 degrees with lower temperatures of 40 degrees or 35 degrees that the difference in favor of the latter is so slight as to hardly pay for the extra trouble and ice. Forty-five degrees is low enough for all practical purposes. Fifty degrees will do reasonably well, but anything above 53 degrees or 55 degrees is very close to the danger line of heavy losses of fat in the skim milk. If a flowing spring or running water can be used, with water at a temperature of 53 degrees to 55 degrees, it will be very satisfactory, as the milk will cool much more rapidly if the water is constantly changing than if at rest.

The cans used in this method should be eight or ten inches in diameter and sixteen to twenty inches deep. Some of the patent cans which are covered so as to be entirely submerged in the water, and yet permit the escape of gas and animal odors are very efficient, as they furnish more cooling surface. But any vessels of the right shape will answer the purpose. The cans should never be tightly covered so as to prevent aeration, but the milk ought to have some protection from outside taints.

Within twelve or eighteen hours after setting, the cream will have risen to the surface so as to show a distinct line of

separation from the skim milk. Glass gauges in the side of the cans are very convenient in noting the separation. It will sometimes require twenty-four hours for all the cream to rise. The two portions of the can's contents may then be separated, either by skimming or dipping off the cream from the top, or by allowing the skim milk to run out from the bottom of the can if it is provided with a faucet for this purpose. The latter process is much more convenient and effective, as it leaves the cream in the can with very little disturbance if the skim milk is drawn off slowly and about half an inch left under the cream. In skimming from the top, the cream is more or less disturbed by the dipping process, and some of it is mixed again with the skim milk and lost. A conical or pointed dipper is best for such work. In using it, insert the point of the skimmer in the middle of the can and press it down slowly until the cream runs over the edges and fills it. Lift out carefully, and repeat this process until the cream is all taken off.

The deep setting system produces cream which is perfectly sweet, but rather thin, usually containing only eighteen to twenty-five per cent of fat.

The Farm Separator.—By the use of the cream separator a much more perfect separation of the cream from the milk may be secured than by any gravity system. This is shown by the increased amount of butter made when the separator is used, and also by the amount of butter fat left in the skim milk, as shown by the Babcock test. It has been found that no system of setting the milk will take out all of the butter fat; in fact, under ordinary conditions, a large per cent is lost. On the other hand, when the separator is used, practically all the fat is extracted. Under the very best conditions, the deep setting system will seldom leave less than .2 of one per cent fat in the milk, and the loss will range from this figure with fresh cows, up to a loss of one per cent or more

with stripper cows. If the conditions are unfavorable, as much as 1.5 or 2 per cent of fat will be found in the skim milk. The average during the entire year of hundreds of tests of the skim milk produced in this system shows a loss of about .75 of one per cent fat.

But the farm separator if properly operated, will leave less than .1 of one per cent of fat in the skim milk. In fact, most users of these machines will not keep a separator that does not habitually skim so as to leave as little as .05 of one per cent fat in the milk, or less. This means then that the separator will produce about three-fourths of a pound more butter from the same 100 pounds of milk than the deep setting process. And it also means that by the latter method, the farmer loses every year nearly one-fifth of his total butter product in the skim milk, with milk of average richness, containing say 3.8 per cent butter fat. With cows producing 4,000 pounds of milk per year, or 150 pounds of butter fat—which is a very reasonable average—this loss would amount to at least 30 pounds per cow, which at 20 cents per pound would be a loss of $6 per year on every cow. It will be seen that this loss soon becomes enormous in the aggregate. For example, in a herd of only ten cows it would mean a loss of $60 per year. The small sizes of hand separators can now be bought for $50 up to $125, according to size and capacity, and they will easily last several years with proper care. It is quite plain that no dairyman having as many as ten cows can afford to be without a separator in buttermaking, as the losses incurred by other systems of creaming would soon pay for the machine.

Besides this, the skim milk is in the very best condition for feeding to the calves and pigs if it is run through while fresh, and fed immediately after separation, while still sweet and warm. If the work of turning a hand-power machine should become objectionable, a light tread-power can be arranged to do the work. Any farm animal can be used for

this purpose, such as a good sized sheep, a pony or horse that might otherwise be idle, or even the herd bull. Many farmers use the tread-power to furnish their dairy bulls the exercise which they need to keep them docile. Even turning the separator by hand does not require as much time and labor as setting and skimming the milk, washing cans, and warming the skim milk for the calves, as in other systems. The cream from the separator can also be regulated to any desired thickness, containing all the way from 15 to 50 per cent of fat. The best consistency for churning purposes is 30 to 40 per cent. When cream is separated while fresh there is much less danger from injurious bacteria, as these germs do not thrive so well in the medium of butter fat as in the whole milk or skim milk.

It has been claimed that the average farmer will never learn to run cream separators. But the machines are comparatively simple, and it will be no more difficult for the farmer to become sufficiently expert to secure good results from them, than it has been for him to learn within the past fifty years how to operate such machines as the self-binder, corn harvester, thresher, and many other delicate and complicated pieces of modern farm machinery.

Before leaving the subject of creaming, we are compelled to mention another method which has been in use from time immemorial, called the shallow pan system. We shall speak of this method only for the purpose of discouraging it in unmeasured terms as a practice which will do more to reduce the quality of farm butter than any other system. It is the method used by our grandfathers and grandmothers, and much to our regret, it is still in use on a large number of farms in this country. After examining the process carefully, no fair-minded person could recommend it, when other methods are offered which are no more costly or troublesome and far more efficient. By this old method, the milk is set in shallow

pans in layers not more than two or three inches thick. The vessels may be of any size, from a gallon crock to a pan large enough to contain the milking from several cows, as long as the depth of the milk is not over four inches. The milk must be set as soon as possible after being drawn from the cows. The temperature required for this method must be comparatively warm, usually about 60 degrees. Some forms of pans are arranged to allow water to flow around the outside, so as to cool them down quickly to the right temperature. The air of the milk room should be pure and free from all odors and dust, well ventilated and slightly moist. The milk must remain in this condition for about thirty-six hours, until the cream has collected at the top and hardened into a thick layer, and the skim milk below has thickened slightly and begun to sour. The cream can then be lifted off in chunks and rolls with a flat skimmer. No milk should be taken with the cream, as this sour milk will cause the cream to sour too rapidly. This cream can not be skimmed off while thin and sweet, as in such thin layers it mixes readily with the milk, and must either be lost or be accompanied by large quantities of the milk. If the atmosphere is too dry, the cream hardens accordingly, and produces specks of curd in butter.

There is no question but that a fine quality of butter can be made by this system when the best conditions are furnished, but the trouble is the farmer is absolutely unable to control the conditions. He is literally at the mercy of the wind and weather. The milk is spread out in thin sheets and exposed to the air and bacteria, so that under changing atmospheric conditions, uniform results are impossible.

From this fact has arisen the old superstition that thunder will sour milk. The electric current, or its accompanying noise, thunder, has no effect on milk; but the warm, humid atmospheric conditions which invariably accompany thunder storms furnish just the right surroundings for the rapid sour-

ing of milk. If the milk is submerged in cool water, or protected in any way from atmospheric changes, it is not affected by thunder storms.

Fresh milk is highly susceptible to odors of any kind. Whenever the shallow pans are placed near anything which gives off the slightest smell or odor, the characteristic taint is sure to be absorbed and appear later in the butter. The practice of setting milk in a damp, moldy cellar which is often half filled with vegetables such as potatoes, onions, cabbage, etc., either fresh or in all stages of decay, can not be too strongly condemned. Likewise the housewife's method of seting milk in crocks in the pantry which opens into the kitchen; the smell of cooking vegetables and meat will surely injure the butter.

But most objectionable of all is the fact that the losses of butter fat in the skim milk by the shallow setting are enormous—much larger than by any other method. The skim milk seldom contains less than one per cent of fat, and the average is about 1.4 per cent loss; many times the losses reach as high as 2 and 2.5 per cent. This is actually a loss of from one-fourth to one-half of the total butter product.

The system also requires a large amount of labor in skimming and washing pans, and a large amount of shelf space for the exposure of the milk. The skim milk is always sour and loppered and is practically unfit for use.

Ripening.—After securing the cream, the next step is to ripen it properly for churning. The ripening process consists in developing a certain amount of acidity in the cream, in order to produce good flavor and exhaustive churning. This process requires good judgment, as no set rules can be laid down. Different conditions require different treatment. The sourness is produced by certain bacteria which break down the sugar of milk into lactic acid. The lactic acid bacteria are so common in milk that under ordinary conditions

the only work necessary in producing acidity is to keep the cream at a temperature which is favorable to the growth of these germs for a sufficient length of time. Sometimes it is best to use for ripening purposes a starter, a quantity of milk in which the lactic acid germs have been allowed to develop in large numbers. A good starter will usually produce a higher, cleaner flavor, and will tend to check and overcome any undesirable fermentations. Starters may be prepared from commercial ferments, or made at home. A satisfactory homemade starter may be some good clean whole or skim milk which has been kept at a temperature of 85 degrees or 90 degrees until it has become thick and sour; or some fresh buttermilk. Use about two pounds of starter for every 100 pounds of cream. The question of commercial starters is so broad and intricate that it is not deemed best to enter into it here. When cream is raised by the deep setting process, it usually contains a good start of acid at skimming, and will ripen readily without a starter.

It is essential to the production of firm butter that the cream be subjected to a temperature of 50 degrees or lower for two or more hours at some time early in the ripening process, in order to congeal the fats in milk which are always melted at temperatures of 85 degrees and 90 degrees—being in a liquid state when drawn from the cow. Unless properly cooled and hardened, these fats will be lost in the buttermilk. If the cream is raised by deep setting, it has already been treated to the low temperature of 50 degrees, and may be ripened immediately after skimming. But when the separator is used, the cream should be immediately aerated and cooled down to 50 degrees and held there some time before ripening begins.

Ripening is one of the most important parts of butter making, for upon it depends the quality and flavor of the butter. If the cream is spoiled at this stage by improper handling, the entire product is spoiled. Butter will have the best

texture when the cream has been subjected to as few changes as possible from the cow to the churn. The acidity of all parts should be alike. When fresh cream is put into the cream can, it should be thoroughly mixed with the rest. No fresh cream should be mixed in within twelve or sixteen hours of churning, as it would not have time to ripen properly, and being slower in churning than the rest would become lost in the buttermilk.

Cream should be raised in temperature slowly and gradually, and stirred so as to allow all parts to heat equally. A correct dairy thermometer is indispensable in butter making. No person can guess at temperatures correctly every time, and uniform butter can not be made without using a thermometer at almost every stage of the work and securing uniform conditions. A great deal of farm butter is spoiled by ripening at too high temperatures and allowing cream to become too sour. This is inexcusable when a floating glass thermometer now costs only twenty cents. Never pour hot or cold water into the cream, except in extreme cases. The can should be set in a larger receptacle and surrounded by water at the desired temperature. The process of placing the cream near a stove for heating is very objectionable, as it does not heat evenly.

If deep setting cream is used, it may be kept cold until the day before churning, when it should be raised to a temperature of 60 degrees or 70 degrees and held there for twelve or sixteen hours. When sufficient sourness has been developed, it should be cooled down for churning. The lower the temperature used in ripening, the longer time will be required. Sixty degrees would sometimes require twenty-four hours, and if it should become necessary to hasten the process, cream will ripen in six or eight hours at a temperature of 75 degrees or 80 degrees. It is best to use the lower temperatures of 60 degrees and 70 degrees when possible. It is hard to state on paper just how cream should look and taste when it is ripe and

ready for churning. This is acquired only by experience. The cream should have a sharp, clean acid taste, with a pleasant flavor. It should have a peculiar smooth and glossy appearance, somewhat thick, but not loppered. By the acid tests it should contain from .50 to .60 of one per cent lactic acid.

Separator cream may also be ripened at 70 degrees, but it will require perhaps eighteen to twenty-four hours to become acid enough for churning. It may sometimes be raised as high as 75 degrees or 80 degrees, which will ripen it in about twelve hours. If a starter is used, it may be readily ripened at 60 degrees in a few hours. Thin separator cream will ripen much more rapidly than thick cream.

After ripening, cream should be cooled down to the proper temperature for churning, or somewhat lower, and held for a couple of hours, or longer if not convenient to churn at once.

Churning.—Churning is the agitation of the cream necessary to cause the particles of butter fat to unite into masses. This is best accomplished by some machine which produces a concussion by allowing the cream to fall or strike with force against the sides. The best forms are the revolving barrel or box churns, or swing churns. Any machine which churns by the use of moving inside fixtures should be avoided, as they agitate the cream poorly and unevenly, lose large amounts of fat in the skim milk, and produce dirt and heat at the inside points of contact. The old time vertical dash churn should be relegated to the past on account of the back-breaking form of work it has furnished for thousands of tired women, to say nothing of the wrong principle of churning on which it operates.

Preparing for Churning.—The churn should first be thoroughly scalded with hot water, and then cooled with cold water. The cream should be poured into the churn through a strainer, to avoid lumps and specks of curd. In the winter time enough color should be added to produce about the same

shade as June butter. The necessary amount can readily be learned by experience. There are several good vegetable colors on the market which are entirly harmless, and full directions for use accompany each package.

What is the Proper Temperature for Churning?—This question is asked oftener than perhaps any other, and the only correct answer is that it depends entirely on conditions. It is impossible to fix any exact temperature that will suit all cases. The best temperature for churning is the lowest temperature which can be used and produce proper granules within a reasonable time. A reasonable time is from thirty to forty-five minutes, and fifty minutes or an hour is not too long. The colder the temperature, the better the granules, and the less fat lost. The real churning temperature is the temperature at which the butter breaks. This is from two to four degrees higher than the starting temperature, from the friction of the machine. If the granules form in less than twenty-five minutes, you may be certain that the temperature was higher than it should have been. If the butter comes in fifteen minutes or less, a large amount of fat is lost in the buttermilk, and the butter will be soft and greasy in texture. Ordinarily from 56 degrees to 60 degrees is about the right temperature for churning under Missouri conditions, and it should very often be lower.

The conditions which affect the churning temperature are —the breeding and individuality of the cows, the composition of the butter fat globules, the period of lactation, the feed of the cows, and the richness of the cream. The temperature should be higher when the cows are in an advanced stage of lactation, and also when they are on dry feed in the winter. When the cream is rich in butter fat, such as separator cream containing thirty to forty per cent, the churning temperature may be very much lowered, usually from 52 to 54 degrees.

With thin cream from the deep setting system, a temperature of 60 or 62 degrees will be necessary.

The churn should be revolved at a speed that will produce the best concussion of the cream at each turn. The gases which are evolved by the agitation should be allowed to escape during the first five minutes. If the cream becomes so thick that it does not fall, it should be diluted with some pure water at the same temperature. One can soon learn to tell by the sound of the churn when the butter is beginning to break. It should then be carefully watched, as it is very easy to churn too much at this stage.

Fig. 1. Butter in Granular Form—Proper Time to Stop Churning.

When to Stop Churning.—The churn should be stopped when the butter has formed in granules somewhat smaller than wheat grains. If there is any difficulty in producing granules

of this size, a small handful of salt sprinkled in the churn will collect them with a few turns. The next step is to separate the buttermilk from these granules, by drawing it off and washing with water. Our grandmother's method has been to continue churning until the butter forms in lumps the size of a walnut or the fist. If one would only think seriously about the matter, it must be plain that such methods will inclose the buttermilk, pieces of curd, etc., on the inside of these chunks so that it can never be removed by subsequent treatment. And how much easier it must be to drain off buttermilk and wash out milk and curd if the butter is allowed to remain in a finely divided state such as that shown by the accompanying picture, fig 1.

This one fault of churning beyond the granular stage means a great loss, as such butter soon becomes rancid, and must be sold at a sacrifice.

As soon as the granules form, then draw off the buttermilk through a strainer or hair sieve, and wash the butter with pure water at a temperature of 50 or 52 degrees. Use about twice as much bulk of water as butter, and allow to stand only a few moments, unless it is desired to cool the butter very materially. Draw off the first washing, and if the last of it does not run off reasonably clear and free from milk, wash a second time as before. The writer can not recommend more than two washings, as every washing takes out just that much of the high aroma and flavor that is so much desired.

Salting and Working.—Nothing but good dairy salt should be used, and never the common coarse barrel salt used by many. The salting may be done in the churn, or the granules lifted out and salted on the worker. In a combined churn, of course the salting and working is all done in the churn. If the butter is salted in a box or barrel churn, about half the salt should be sifted on one side, the churn revolved, and the remainder sifted on the other side. By revolving the

churn a few times, the salt will become fairly well mixed, and the butter should be taken out and finished on the worker. The difficulty with this method is that it seldom leaves the right amount of salt in the butter when finished. It is impossible to tell exactly how much moisture the granules contain, and when this moisture is worked out it will take with it large amounts of the salt. The ordinary market requires three or four per cent of salt in butter, which is about three-fifths of an ounce to the pound. To insure this amount, at least an ounce and a half of salt per pound of butter should be put in when salted in the churn, and even then it is hardly possible to get two successive churnings alike.

The writer is of the opinion that the best way to secure uniform saltness is to take the butter out of the churn in the granular form, and press it lightly on the worker without causing the granules to cohere much and yet allowing most of the water to escape. Then salt at the rate of one ounce to the pound and distribute the salt evenly through the mass and allow to stand until thoroughly dissolved. Then work it a second time to avoid mottles and streaks, and thoroughly mix the salt. The best temperature for working and packing butter is about 55 degrees. The least amount of working that will accomplish the object of removing the moisture and incorporating the salt is best for high flavor and good texture. It is very easy to work butter too much and destroy the grain. When finished, the granules should be so well preserved that they appear when broken like a section of broken cast iron. If it is impossible to keep the butter cool enough to allow time for the salt to dissolve and working a second time, of course very good work can be done with one careful working. There are many forms of workers, but the best for home use is the lever table worker.

Packing and Marketing.—Next to ripening and churning the cream, the most important thing is to pack and market the

butter in an attractive form. The large majority of consumers base their opinion of butter on its flavor and appearance. A little extra care and neatness here will mean an increase of many dollars' profit during the year, while even good butter can be ruined for the market by slovenly packing. Anybody can make butter of some sort, but only a clean and careful maker can produce butter of good quality and market it in a pleasing form. So here is the final test of the artist in buttermaking.

There are as many different forms of packing as there are different trades, and each maker must pack to suit the trade he is supplying. As a rule, private home trade will pay the highest prices, and for this purpose pound prints are very acceptable. The molds turn out the butter in oblong blocks, either pounds or half pounds. They should be carefully wrapped in wet parchment paper, and kept cold until marketed. Others prefer butter in stone jars or wooden pails. The boxes made of pressed fibre are very cheap and convenient. In the large markets, the trade generally calls for 60 or 80 pound tubs. When wooden packages are used, they should first be steamed and cooled, and lined with parchment paper on the bottom and sides, to protect the butter. The butter should be packed in firm and solid, and the top smoothed off either exactly level or slightly lower than the top. Then lay a cloth circle on top, and run a little salt into its meshes. Finally put on a parchment circle and fasten on the top of the tub. If the home market does not pay a reasonable price, or the demand is small, there is no question but that the farmer can secure good prices for his butter by shipping to the city markets and commission houses, if he will turn out the right sort of product.

Part IV.

THE DAIRY HERD.

By H. J. Waters, Dean Agricultural College.

The proper selection, maintenance and development of the dairy herd lies at the foundation of all permanent success in dairying. While the organization of factories, wherein butter and cheese may be manufactured more economically than on the farm, may stimulate and encourage the development of the dairy industry, it is nevertheless true that this stimulus will be only temporary and will soon fail if the farmers are producing the milk without a satisfactory profit.

A thoroughbred herd of dairy cows is not necessary to success. In fact, for the beginner, it is perhaps advisable for him to select the best dairy cows of his local community, which in this State will generally be grade Shorthorns or Shorthorns mixed with Jersey blood. The combination beef and dairy cow is claimed by many authorities to be the most profitable on the whole, inasmuch as the cow herself may be readily and profitably converted into beef when she proves unsatisfactory for dairy purposes; that she will drop a large and thrifty calf that may be made into veal or into beef at a profit, and in this way add materially to the profits of the business. On the other hand the preponderance of evidence seems to be on the side of the special dairy cow. The comparative tests show that such a cow will produce butter at less cost, just as the other type of animal will produce beef to a better advantage, and that

in the end the dairyman will be acting most wisely who plans to form his herd out of such cows.

I. *Selection.*—After having gotten the herd together, the most rigid selection and the most intelligent breeding will be necessary to improve its quality or even maintain its excellence. No matter how judiciously the herd may have been selected, there is almost certain to be a number of animals that will fail to produce a profit and a wide difference will be shown in the amount of profit returned by different cows. It is therefore absolutely essential to the most rapid progress and to the highest degree of success that the dairyman determine accurately the number of pounds of butter or milk produced by each cow each year. An investment of less than ten dollars in a Babcock milk tester and a pair of spring balance scales and an expenditure of a comparatively small amount of time and labor will furnish this information and it is certain to cause a great surprise to the owner of the herd.

As a striking illustration of the value of such a test, the following is mentioned: sometime ago a prominent dairyman—president of his state dairy association—applied the test to his own herd, not so much because he believed it necessary or advisable, but to satisfy his own curiosity. His herd consisted of cows of his own breeding and his sons did the milking. Before beginning the test, however, he made a note of the joint opinion of himself and his sons as to the best half dozen cows in his herd. When the year's record was complete, to his great surprise it was found that the best cow in his herd he had placed fifth in order of excellence, the second best animal was a cow not on his merit list and the fourth he had placed first.

A somewhat similar experience by the writer, while connected with the Pennsylvania Experiment Station, in a herd of twenty-five cows that had been milked for several years by two very intelligent men; and before the test was applied I

asked them to select the best ten animals in the order of their excellence. The third and fourth cows in this list proved to be among the poorest of the entire herd and were so utterly worthless that they were sold to the butcher at the end of the year. The cow that these men placed second in the order of excellence produced a profit during the year of $4.55, while the cow that they placed sixth yielded a profit over and above the cost of feed of $37.65; and yet these were intelligent men and felt that they were thoroughly acquainted with the cows in this herd.

At the Wisconsin Experiment Station were made a number of yearly records of the cows in the herds of six patrons furnishing milk to their creamery.

"At farm 'A' the annual yield of milk ranged from 3,792 to 6,203 pounds, and of butter fat from 147 to 296 pounds. At farm 'B' the milk yield ranged from 5,193 to 7,887, pounds, and the butter fat from 245 to 312 pounds. At farm 'C' the milk yield ranged from 4,411 to 8,132 pounds, and the butter fat from 222 to 336 pounds. At farm 'D' the range of milk was from 4,847 to 6,570 pounds, and of butter fat from 223 to 300 pounds. At farm 'A' there were three cows which did not produce milk enough to pay for their feed. The entire herd of twelve cows gave a profit of only $75; $50 of this amount was from three of the cows, while the combined profit from the other nine was only $25. The twelve cows on farm 'C' earned a total profit of $228, instead of $75 as on farm 'A,' but even on this farm there was a considerable difference in the cows. The value of the product from the poorest cow was $37.96, and from the best $60.72. The best cow gave a profit of about $31, while the poorest gave a profit of only $8."

A record of one year of a herd of 25 cows at the Connecticut Experiment Station shows that the annual yield of milk varied in the case of different individuals from three thou-

sand to eight thousand pounds and the annual yield of butter from 165 to 509 pounds. The best cow gave a profit (above cost of feed) of $42.82 while the poorest cow had been kept at a loss of $4.09. Eight of the twenty-five produced a profit of less than $10 each. The best cow gave as much profit as any three of the average cows of the herd. Thus this best cow was worth more than three times as much as the average cow of the herd inasmuch as the labor of milking and caring for one cow and of keeping her when she is dry is much less than of three cows.

At the New Jersey Experiment Station during the past four years the best cow of a grade herd produced a profit over the cost of feed of $46.64, with butter at twenty cents per pound, while the poorest cow yielded only $5.84 per year.

These cases are cited to emphasize the necessity of keeping a record of every individual in the herd and of weeding out all animals that fall below the limit of profitable production, without regard to their pedigree, their looks or their disposition. It is safe to say that a cow producing less than two hundred pounds of butter will not pay to keep. At the end of the first year all animals falling below this limit ought to be sold without delay.

While under ordinary circumstances a yearly butter yield of 200 pounds will pay all expenses and leave a little profit, no dairyman should be satisfied to let his standard remain at that point long. Even with his first crop of heifers, if he has selected his sire wisely, the standard might be safely raised to 225 pounds, and with each succeeding generation an advance of 25 pounds, until no animal is producing less than 300 pounds. This is a high mark but it may be reached in a surprisingly short time, with proper selection, breeding, feeding and management.

II. *Breeding.*—The progress made by weeding out the unprofitable animals in the herd will be short lived unless

you are able to produce good animals from this foundation. For this purpose it is essential to have a high class sire. In all cases he should be a thoroughbred representative of one of the well established dairy breeds. Too great care can not be exercised in his selection, and under no circumstances should cheapness be a prominent consideration in his selection. He should be the offspring of a dam that is known to be a good dairy cow, and should be sired by a bull that has produced valuable dairy animals. Under no circumstances should a good individual of poor breeding be selected, and it is just as unfortunate to select a poor individual, even though he happens to have a fine pedigree. As an illustration of the possibilities in this direction, I cite an instance in my own experience at the Pennsylvania Experiment Station, where a two year old heifer produced in her first period of lactation three hundred and thirty-four pounds of butter. Her dam in her prime, produced but 260 pounds of butter in a single period of lactation. Clearly a portion of this superiority must be attributed to the sire.

An even more striking illustration is found in our experience with the Missouri Agricultural College herd of registered Jerseys. One bull used for two years—a comparatively cheap one—failed to produce a single heifer that proved superior to its mother. In other words, so long as we kept this bull our herd was at a standstill and all progress was barred. The next bull, apparently no better as an individual, but higher in price because he was the direct descendant of a family of heavy butter producers and was out of a cow with a large butter record, and was himself the sire of several tested cows, did not, in the three years he stood at the head of the College herd *fail in a single instance* to produce a heifer that was better than its mother. In this case progress was everywhere apparent. No one, not even the State, could afford to own at any price such a bull as the first one, and any price

within the bounds of reason would have been cheap for the second. Bear in mind that the bull is half the herd, that every heifer dropped takes half her blood from him.

III. *Development of the herd.*—Special attention should be given to the care and management of the cows. They should be developed as we would develop great speed in horses and great endurance in men. It should be borne in mind that the first two periods of lactation of a cow are the formative or training periods and that during this period especially, and at all times in general, she should be fed and milked regularly, should be properly sheltered, should be treated kindly, in short every reasonable effort should be made to induce her to become a copious and persistent milker. Fix this habit in the cow during her early life and she will retain it; in time she will transmit it to her offspring and you have a high class dairy cow in every respect.

IV. *Selecting and Breeding to a Dairy Type.*—After the unprofitable cows are eliminated, after we have made sure of our foundation stock, we should begin selecting and breeding to a dairy type. In no case, however, should we think of buying or keeping a cow simply because she happens to conform closely or even perfectly to what is considered the ideal dairy type. Unless she will produce a good yield of milk or butter at a reasonable cost she is worthless as a dairy cow. We keep cows for what they will produce. As a general rule the cow that most nearly conforms to the dairy type as distinguished from the beef type will produce milk or butter most economically and most profitably. This is strikingly shown by the results of the year's record of the dairy herd of grade cows at the Minnesota Experiment Station. They were all fed alike and a careful record kept of the cost of the food consumed and milk and butter produced. It was found that the cows representing the beef type, blocky and plump, produced butter fat on average cost of .175 cents per pound. The amount

produced by these beefy cows was satisfactory but they required too much food for a pound of butter fat. A second group of four cows, approaching the beef type, but less blocky and plump, produced butter fat at an average of .151 cents per pound. A third group of three cows with spare and angu-

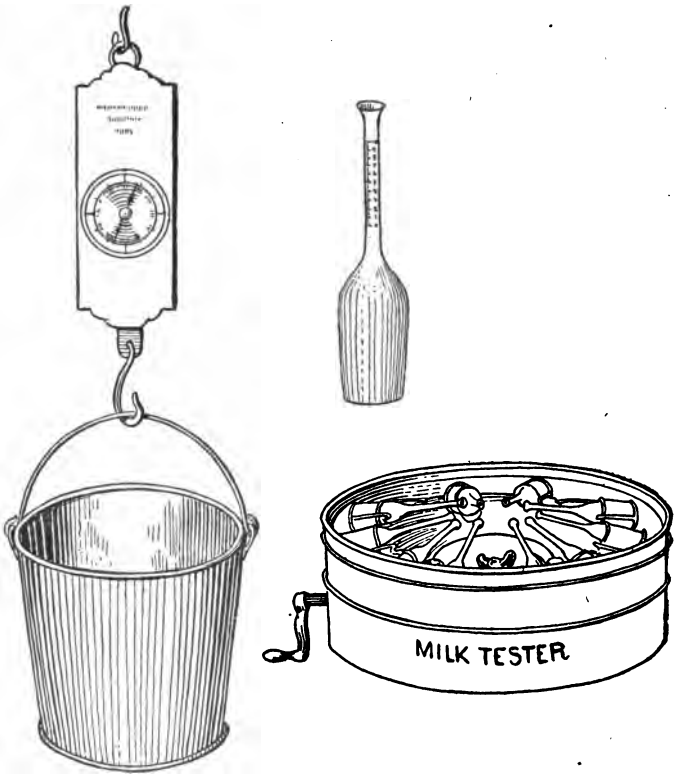

Fig. 2. Spring Balance for Weighing Milk, and Babcock Milk Tester from Allen, United States Department of Agriculture.

lar bodies, but deficient in depth and strength, produced butter for a cost of .146 cents per pound. A fourth group of twelve cows, spare and angular, with deep bodies and large stomach capacity produced butter fat at an average cost of .121 cents

per pound. These results exemplify a general rule which it would be well for every dairyman to observe. It is well known that there are individual exceptions, but in the main there is no doubt but the accepted dairy type should be as nearly approximated as possible in selecting and breeding our dairy animals. Under no circumstances would I advise the use of a bull that materially deviated from it.

V. *Making the Test.*—Many imangine that a large amount of skill and labor and considerable record keeping are necessary to accurately test a herd. On the contrary the operation is quite simple and may be performed by any one of average intelligence without special instruction and with comparatively little labor.

It is not necessary for ordinary purposes to weigh the milk every day in the year although this is recommended. If the milk is carefully weighed five days in succession in the middle of each month, say on the 13th, 14th, 15th 16th and 17th, the yield for the whole month may then be computed with sufficient accuracy for all practical purposes. Provide a self-sealing glass fruit jar for each cow in the herd and during the days the milk is being weighed draw a sample of each cow's milk at each milking and at the end of the five days test it for butter fat if you have a Babcock tester, or send it to your creamery or to the Agricultural College to be tested. The daily samples are kept in the fruit jars until the end of the five day period and may be kept in good condition for testing by adding a small amount of such preservative as bichloride of mercury or bichromate of potash to each jar. After having computed the amount of butter fat produced by a given cow, add one-sixth to this amount to convert it into commercial butter.

FEEDING THE DAIRY HERD.

In the preceding article on the building up of the dairy herd much stress was laid on the selection, breeding and management of the animals for the greatest profit and the most rapid progress. Proper feeding is quite as essential to success and is quite as important a factor in the development of a dairy herd as any of those already mentioned. All of these elements of success must be considered together. They can not be separated and one set above the other in importance. For, a herd however well selected and highly bred, will fail to produce satisfactory results unless properly fed, and not only so, but these animals will ultimately lose or fail to transmit the high qualities that a combination of good selection, good breeding and good management and good feeding produced. On the other hand if the selection has been improperly made, no amount of intelligence in feeding will suffice to produce satisfactory profits.

The two most common mistakes are:

(1) In feeding an improperly balanced ration.

(2) In feeding an insufficient amount.

As to the balancing of the ration, it may be well to divide our common feeds into two classes, as follows:

Class I. Embracing such feeds as corn, corn fodder, timothy hay, millet, sorghum, oat straw, etc., which contain a large amount of fat or heat producing material, but are notably deficient in the elements required for the production of muscle, growth in young animals and the casein or cheese portion of milk, etc.

Class II. Embracing such as cottonseed meal, linseed meal, bran, ship stuff, oats, clover hay, cowpea hay, etc., which supply the muscle and milk-making qualities lacking in the first class.

In Missouri the foodstuffs in class I are much cheaper and more abundant than are those of the second class, with the exception of clover and cowpea hay and should always form the foundation or basis of the ration, but should not, on account of their cheapness, be fed exclusively as is too often done.

A proper combination of the two classes will balance the ration, increase the flow of milk and the amount of butter produced, and will materially increase the profits returned.

It is often a question in the minds of the beginners especially as to whether the increased product obtained by balancing the ration is not more than offset by the increased cost of the feed. If the selection of material for balancing the ration is not wisely made and advantage is not taken of the market this may easily occur, yet if the feeder will make a careful study of the feeds ordinarily produced or sold in his locality and combine them to the best advantage, the cost per cow per day need not be materially raised, while the yield of milk and butter may be largely increased.

A few reasonably well balanced rations made up from material that is within easy reach of every dairyman every season will suffice to illustrate the point:

1. 7 to 9 pounds of corn, 3 pounds of bran, 15-18 pounds of clover hay.

2. 7 pounds of corn, 3 pounds of oats, 15-20 pounds of cowpea hay.

3. 10 pounds of corn, 20 pounds of cowpea hay.

4. 7 pounds of corn, 3 pounds of cottonseed meal, 10-15 pounds of corn fodder.

In all of the above rations it is expected that all the hay the cows will eat will be given and that they have access to good corn fodder during the day. The amount of grain will need to be varied according to the production and size of the cow.

Observe that corn is the prominent grain in all these ra-

tions. While much has been said against this grain as a dairy feed, it is nevertheless a fact that for cheapness and efficiency it is unexcelled, and for the greatest profit, must form the basis of all dairy rations. It is only when it is used as the exclusive grain ration and in combination with such roughness as corn fodder, timothy, sorghum, or millet hay that these criticisms apply.

It will be observed further that timothy hay is not included in any of these rations. Ordinarily it is too expensive to be fed to any class of cattle with profit. The dairy farmer will not find it profitable to grow timothy except for pasture unless he has a surplus of land, and even in that case it will be much better to devote the land to clover or cow peas. Whatever the ration fed, the cows ought to be allowed to run to good bright corn fodder when out of the barn during the day.

The corn ought to be ground for dairy cows, and unless some light bulky material such as oats or bran is mixed with it, better results will be gotten from crushing the corn and cob together than from the same quantity of shelled corn ground, and at less expense.

As between bran and oats there is a slight difference in favor of the oats. Thus when bran is selling at $10 per ton, oats will be a cheaper feed at 16 cents per bushel.

As between cottonseed meal and linseed meal, the experiments show that for the production of milk, butter or beef a ton of cottonseed meal has from $2 to $3 more value than has the same amount of linseed meal and it can usually be bought at from $3 to $6 per ton less. When cottonseed meal can be bought delivered to your railway station, at from $18 to $20 per ton in car lots, as it usually can in the fall, the dairymen of each community ought to club together and buy at least a car to protect themselves against a rise in the price of bran and oats, which usually occurs about the middle of the winter of each year. Cottonseed meal at this price is far

cheaper than bran at $15 per ton or oats at 25 cents per bushel.

As between clover hay and cowpea hay, very few accurate experiments have been made, but these together with considerable practical experience, at the College and by local dairymen, indicate that cowpea hay is better than clover. The cows will eat more of it, and it goes further toward balancing a corn and corn fodder ration than clover. Both, however, are most excellent dairy feeds and every dairyman ought to make sure of a liberal supply every year. A few very successful dairy farmers have for the past three or four years fed only corn, cowpea hay and corn fodder and claim that the butter yields are quite as large as when they paid out large sums of money for bran and fed it in connection with corn and timothy hay. Corn and good cowpea hay make a fairly well balanced ration.

After the dairyman has his business well established and on a paying basis, a silo in which to store green corn for winter feeding will be the next important improvement to be made.

The Amount of Feed.—Less satisfactory and accurate advice can be given on this subject than perhaps upon any other in connection with dairying. Scarcely any two cows will require exactly the same amount for the most profitable production. Certain it is that any satisfactory dairy cow may be under fed and on that account fail to return the largest profit of which she is capable. It is likewise true that the average cow may be over fed, that is given more than she can convert into milk and butter economically, and as a result the profits be reduced. Most feeders, however, and especially beginners, err on the side of under feeding. Frequently a bunch of cows is picked up in a neighborhood— a few in a place—that will not average over 150 pounds of butter per year under the care and feeding they have been receiving, but when fed a better balanced ration and more liberally will produce an average of 250 pounds—this increased production meeting the increased cost of feed and paying a good profit besides.

The proprietor of the herd ought, if possible, to do the feeding, and the requirements of each cow should be carefully studied. The food record and the milk and butter record of each cow should be watched as closely as would be the receipt and expenditure charts of any other business enterprise. By this it is not meant that the food of each cow could be weighed and a record kept with profit, on account of the great amount of labor, but the feeder will be able to approximate very closely the amount of grain each animal is consuming. As long as an increase in the amount is followed by such an increased production as to pay a profit, the animal is certainly not over fed. As a general rule a good dairy cow ought not to lay on much fat when in full flow of milk. If she does, the chances are she is being over fed. On the other hand if she milks down very thin the probabilities are that she is not being fed enough for the best results.

Missouri State Board of Agriculture

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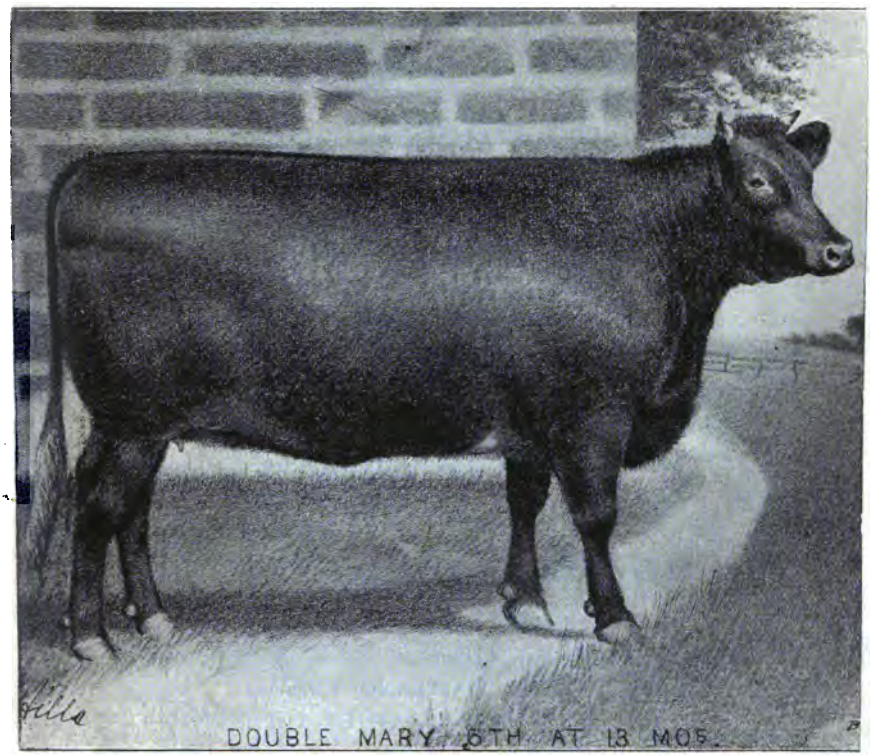

Tuberculosis in Cattle.

PART I. CROP REPORT.
PART II. TUBERCULOSIS IN MISSOURI CATTLE.

COLUMBIA, MISSOURI.

These Bulletins sent Free upon application to Geo. B. Ellis, Secretary.

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FARMERS' INSTITUTES.

On account of the effects of the drouth the institute meetings will not begin this year until about October 1st. About forty meetings have up to this time been located, but as it is necessary to locate all the meetings before the itinerary can be made out to the best advantage, the announcement of the dates cannot be made until the issue of the September Bulletin.

If there has ever been a time in the history of our State when institute work was profitable it is certainly now, and we hope those who are taking the lead in working up the meetings in the different localities will awaken an interest that will insure profitable meetings. It may be that no one now living will witness another year like 1901, but we are sure to have drouths that will cause considerable loss. Something may be learned about how to provide an abundant supply of water, saving moisture by right methods of cultivation, by adding humus to the [illegible] correct systems of rotation, etc., that will enable the farmer to lessen, not entirely overcome, the bad effects of the next drouth. Let every farmer feel that these meetings are his and that he will do what he can to make them a success.

PART I.

CONDITION OF CROPS AND LIVE STOCK, AUGUST 1ST, 1901.

Summary of Crop Reports.	State	Northeast	Northwest	Central	Southwest	Southeast
Corn, condition compared with average crop	21	25	31	15	13	23
Corn, amount that will not make grain	65	58	56	75	73	64
Oats, percentage of crop sown that will be thrashed	24	33	39	14	18	17
Oats, yield per acre of what is thrashed, bu.	14	16	16	12	12	15
Flax, percentage of crop sown that will be thrashed	37	66	5	13	65	
Flax, yield per acre of what is thrashed, bu.	2.9	3.2	4	1.9	2.9	
Cotton, condition	54				39	69
Tobacco, condition	38	45	75	13	18	41
Clover, condition of seed crop	14	18	15	8	12	17
Apples, condition	34	30	31	31	35	43
Peaches, condition	41	43	41	33	39	47
Melons, condition	23	32	30	14	16	25
Grapes, condition	49	48	49	48	41	57
Cattle, amount stock cattle shipped account drouth	29	31	25	46	30	13
e, average loss per head on what has been shipped out compared with June 1	22	26	16	29	31	10

CROP REVIEW AUGUST 1ST.

In making this report it may be interesting to state that the information for this office is gathered from correspondents living in every county in the State, 107 counties being represented in this report. These correspondents are practical farmers and in addition to their own observation are expected to base their reports upon conditions gathered from the opinions of many farmers as they can see and communicate with.

CORN. For many years corn has been King of the farm crops of this State and remains so today although damaged to a very great extent by the drouth. The value of the poor crop if only our low estimates are realized will be greater than that of any other crop for this year. The

condition at this time is only 21 as compared with 69 one month ago and 96 one year ago. The average condition on August first of the corn crop for the past eight years as shown by the records of this office is 90. The condition for the respective years from 1893 up to 1900 are as follows: 97, 88, 108, 85, 89, 80, 81 and 96.

Our reports show that 65 per cent of the entire crop for the State is entirely beyond recovery and cannot make any grain at all and that the condition of the 35 per cent that will produce grain is 60 per cent. This 35 per cent includes generally the corn on bottom lands, clover and cow pea stubble and in localities especially favored with rain.

The Northeast section shows a condition of 25 with 58 per cent that will not make grain; Northwest section shows a condition of 31 with 56 per cent that will not make grain; Central section, condition 15 per cent with 75 per cent not producing grain; Southwest section, condition 13 per cent with 73 per cent that will not make grain; the Southeast section, condition 23 per cent with 64 per cent that will not make grain.

The condition of what will produce grain is in the Northeast 60, Northwest 70, Central 60, Southwest 50, and Southeast 65.

The counties showing the highest condition are as follows: Lewis 42, Putnam 38, Sullivan 70 of the Northeast; Andrew 50, Atchison 63, Grundy 36, Holt 37, Mercer 55 and Worth 50 of the Northwest; Saline showing a condition of 30 is the only county in the Central division that approaches one-third of a crop; Webster 40, McDonald 50 are greatly above the average in the Southwest; Carter 33, Madison 41, Mississippi 63, New Madrid 30, St. Louis 33, Scott 37, Stoddard 30 are the highest in the Southeast. The recent rains that have fallen in many counties will greatly improve the fodder and it is possible may slightly raise the present conditions if good rains continue.

OATS.—The July report showed that only about 50 per cent of the oats were worth harvesting. This report shows that 24 per cent of the crop that was sown will be threshed with an estimated yield of 14 bushels per acre for the acreage threshed.

FLAX.—Only 37 per cent of the crop sown will be threshed, the remainder mostly put up for feed. Light flax makes splendid feed for cattle if fed with care and mixed with corn fodder or other forage. The yield of flax for this year is estimated at only 2.9 bushels per acre as compared with 9 bushels in 1900. This estimate is based upon the amount threshed but if based upon the amount sown makes a yield of only 1 bushel per acre.

COTTON.—This crop has declined 11 points during the month, the condition now is only 54 compared with 89 one year ago.

TOBACCO.—Condition 38 compared with 90 one year ago.

CLOVER.—The clover hay crop was fairly good in many places but the ground was so dry in most counties when the first crop was cut that no seed will be harvested. The seed crop will be almost an entire failure, the condition for the State is only 14.

APPLES.—The following report of the fruit crop is based upon the reports of the regular correspondents supplemented by special reports received from a number of the leading horticulturists of different parts of the State.

In a few counties the apple crop has been damaged by sun burn but the opinion of most of our correspondents is that where good rains have fallen there will soon be a decided improvement. The condition as shown by our regular correspondents is 34 for the State; Northeast 30; Northwest 31; Central 31, Southwest 35, Southeast 43. The average condition given by our special correspondents is somewhat higher, being about 40 per cent for the entire State. Apples are generally small and will need thinning from 10 to 30 per cent to produce good sized fruit. In orchards that have been well cultivated and sprayed the crop is in fairly good condition, but in neglected orchards the fruit has not developed well and is falling badly. The fruit is generally free from scab or insects. In some counties the trees are dying from the effects of the drouth and to a great extent is this true of the young trees set this year. The counties showing an average condition of 40 per cent or more are as follows: Northeast section, Audrain, Clark, Knox, Pike and Warren; in the Northwest section, Andrew, Atchison, Caldwell, Mercer, Nodaway, Platte, Worth and Holt; Central section, Morgan, Pulaski, Randolph and Saline; Southwest section, Barry, Douglas, Polk, Webster, McDonald, Ozark, Taney and Wright; Southeast section, Cape Girardeau, Carter, Franklin, Howell, Iron, Jefferson, Madison, Oregon, Perry, St. Louis, Scott, Shannon and Texas.

PEACHES.—Conditions are very much the same as for apples except that the dry weather has prevented them from rotting as badly as usual, the rot being almost unknown at present. The condition of the crop for the entire State is 41 as compared with 76 one month ago. The rain has fallen in time to greatly benefit all the late varieties.

MELONS.—The condition of the melon crop is very poor, being 23 for the State. The highest average is 32 in the Northwest, the lowest 14 in the Central. The Southeast, where a great many melons are grown, shows an average of 25.

GRAPES.—Grapes are perhaps least damaged by the drouth of all the fruits. Where the vineyards have been well cared for there is a

prospect for a fair crop of fruit and the quality will be above the average because the dry weather has prevented the grape rot.

CATTLE.—The drying up of the pastures early in July and the failure of the water supply in many places necessitated the shipping out of a great many cattle, sheep and other stock. We are inclined to think, however, that a great many cattle that have been shipped could have been held with profit by the farmers if the fear of panic had not overcome them. Our reports show that 29 per cent of the stock cattle of the State have been shipped on account of the drouth, the average of the different sections being as follows: Northeast 31, Northwest 25, Central 46, Southwest 30, Southeast 13. The late rains no doubt, will stop the shipment of cattle and we believe if the farmers will cut the entire crop of corn for fodder that there will be an abundance of feed to carry all kinds of stock through winter in fairly good condition. There has been a great loss to the cattle owners an account of throwing so many cows and young cattle on the market at one time, estimated by our correspondents at from $2 to $16 per head, or an average loss on what has been sold of about 22 per cent. The highest loss, 29 per cent, is in the Central Section where the greatest number, 46 per cent, has been shipped out. The least loss is 10 per cent in the Southeast section, where the lowest number only 13 per cent has been shipped out.

REMARKS OF CORRESPONDENTS BY SECTIONS AND COUNTIES.

NORTHEAST SECTION.

ADAIR.—75 per cent of the corn will not make grain. None of the oats will be threshed. Clover dying, apples dropping badly.

AUDRAIN.—Corn almost an entire failure, farmers are making a noble effort to hold all their young stock, a fine rain on the 29th.

CLARK.—One correspondent reports cattle shipped in on account of drouth. In another part of the county 20 per cent shipped out. Good rain July 28th.

KNOX.—Has been no rain for two months. 65 per cent of the corn will not make grain.

LEWIS.—A fine rain the 28th, the very earliest corn will make the best crop, no oats threshed, cow peas doing fairly well, fruit burning.

LINCOLN.—65 per cent of the corn will not make grain.

LINN.—The drouth is unprecedented, 40 per cent of the stock cattle have been shipped out, corn will make nothing unless it rains.

MACON.—25 per cent of the stock cattle shipped out with a loss of from 25 to 35 per cent.

MARION.—80 per cent of the corn will not make grain, peaches falling badly.

MONTGOMERY.—Wells, ponds and creeks dried up, calves are not worth $8 that sold for $20 a year ago.

PIKE.— 75 per cent of the corn will not make anything. Apples and peaches burning on the trees.

PUTNAM.- Not half feed enough put up at this time to feed the stock, early corn about dead, late corn will make one-third to one-half a crop. Another correspondent says, with rains soon we would probably get one-half a corn crop. July 29th, good shower.

RALLS.—No rain since the first of June, early planted corn firing, apples sun burned, hay one-third of a crop.

ST. CHARLES.—With rain in a few days late corn would make something, condition of apples only 20 per cent.

SCHUYLER.—Loss on stock cattle since June 1st 33⅓ per cent. Without rain soon one-fourth of the corn will not make fodder.

SCOTLAND.—Loss on cattle $1.50 per hundred, stock not generally starving yet but are nearing such a condition.

SHELBY.—July 29th, fine rain last night insuring one-third of corn crop, full crop of sorghum and millet, will stop shipping out cattle and hogs. Another correspondent says with good rains corn will make ten bushels per acre.

SULLIVAN.—40 per cent of the stock cattle have been shipped out. Millet almost a failure, corn fair.

WARREN.—No rain except local shower[illegible]r two months. All early corn past redemption, only very early oat[illegible]as any grain worth threshing, apples cooked on the trees, water very scarce.

NORTHWEST SECTION.

ANDREW.—Condition of corn 50 per cent, oats will yield 7 bushels to the acre, no cattle shipped out that I know of.

ATCHISON.—Clover in bad condition, corn from one-half to three-fourths of a crop, good rains 27th and 28th, oats 25 to 30 bushels to the acre.

BUCHANAN.—Only a small percentage of the corn will make

anything except fodder, about 50 per cent of the stock cattle shipped out.

CALDWELL.—With abundance of rain and cooler weather there will be considerable corn. One correspondent reports 75 per cent of stock cattle, another 80 per cent, another not any. Grasshoppers are eating the fodder. Good rain in western part of county on the 28th.

CLAY.—Apples almost a failure, 25 per cent of the stock cattle shipped out at a loss of about 25 per cent.

CLINTON.—Slight showers since the 26th, corn crop beyond redemption except the late planted, many stock cattle shipped out at a great sacrifice.

DAVIESS.—Pastures short, stock seem to be doing very well, 20 per cent of all stock being fed, apples will be a failure unless it rains soon.

DEKALB.—Of the corn acreage two-thirds will make no merchantable corn. Another correspondent says if it rains soon corn will make one-half a crop, pastures completely dried up, apples and peaches very poor.

GENTRY.—Farmers are prepared to sow forage crops as soon as it rains, from one-half to three-fourth of the corn crop is past recovery.

GRUNDY.—Corn from 20 to 50 per cent, early planted and well cultivated will be fair, corn on thin soil will not make anything.

HARRISON.—Rain on the 28th, may improve the corn; condition now about 50 per cent.

HOLT.—Conditions are distressing, 50 per cent of the stock cattle shipped out.

JACKSON.—Apple and forest trees are now dying in a few places, 50 to 75 per cent stock cattle shipped at a loss of from $8 to $10 per head.

LAFAYETTE.—Many farmers hauling water, stock are being fed, no clover for seed, apples and peaches worthless.

LIVINGSTON.—Good rain the 28th, no clover seed, pastures burned up, grasshoppers eating the corn.

MERCER.—50 to 60 per cent of a corn crop will be raised, 30 per cent of the cattle have been shipped out.

NODAWAY.—No rain to benefit the crops for four weeks, hottest day, 24th, 110½ degrees.

WORTH.—Very dry and hot, early corn damaged but if rain comes soon will produce a fair crop, apples have dropped badly. No cattle shipped out.

CENTRAL SECTION.

BENTON.—No rain for ten weeks, everything dried up, 50 per cent of the stock cattle shipped out.

BOONE.—Good rain 29th and 30th.

CALLAWAY.—50 per cent of the stock cattle shipped out at loss of 40 per cent.

CAMDEN.—It is feared that clover is entirely killed in most fields, the local showers have been too light to be of benefit.

CHARITON.—We have the poorest prospect for a corn crop that we have ever had, about all we can get from the corn is the fodder.

COLE.—Everything burned up except wheat, worst drouth ever known, 30 to 50 per cent of the cattle shipped out.

COOPER.—Less than one inch of rainfall between the 17th of April and July 27th, corn almost an entire failure.

DALLAS.—Corn generally green yet, but few shoots on what has tasseled, the worst drouth for 33 years.

LACLEDE.—Only two and 5/8 inches of rain from April 17th to July 26th, in some parts of the county there will be a light crop of corn, in other places scarcely any at all. Another correspondent says good rain on the 22nd, peaches drying on the trees.

MARIES.—One year old steers that were worth $20 on June 1st, are offered for $10 now without a buyer. Another correspondent says, the worst drouth I ever saw. Fires have done much damage in the past two weeks, one-fourth inch rain July 27th. Another correspondent reports good showers on the 28th.

MILLER.—Very few oats, but little hay, meadows and pastures badly killed out, many trees dying, a great deal of the corn will not make fodder. 70 per cent of the stock cattle have been shipped out. Another correspondent reports only 10 per cent of the cattle shipped out.

MONITEAU.—Farmers sowing millet and turnips for feed, corn almost a failure.

MORGAN.—Oats a total failure, unless rain falls in ten days corn will be a total failure.

OSAGE.—A few oats cut for feed but none worth threshing. Only five per cent of a corn crop can be raised.

PETTIS.—Looks now like no corn will be made. Local showers yesterday and today may possibly insure us some fodder, forage crops will be planted, a great many cattle have been shipped out at a heavy loss.

PHELPS.—The worst drouth in the history of Phelps county, there will be practically no corn, oats or hay.

PULASKI.—There will not be enough raised in this county to feed one-half the stock.

RANDOLPH.—A good rain soon would make one-fourth to one-third of a corn crop.

SALINE.—Rain on 26th, 27th and 28th, corn from 10 to 50 per cent, apples one-half a crop.

SOUTHWEST SECTION.

BARRY.—Corn nearly a total failure, light rain the 26th, 25 per cent stock cattle shipped out at a loss of one-third to one-half.

BARTON.—I have lived in this county 33 years and this is the worst failure I have ever known, corn is being cut. Another correspondent says there will not be ten bushels of corn raised in his neighborhood. 20 to 50 per cent of the cattle shipped out.

BATES.—July 18th and 22nd two light showers but not sufficient to put the corn in growing condition. Another correspondent says, cattle have depreciated about 40 per cent all around, stockmen are visiting other states for the purpose of finding pastures and winter feed. Good rains reported in places on the 29th and 30th.

CASS.—No vegetables, early corn all gone, with rain late corn will make something. Oats a total failure, flax not worth cutting, apples and peaches dried up.

CEDAR.—The worst drouth in 30 years, a few farmers sacrificing their cattle at 40 per cent of former value, stock hogs are worth two cents a pound. I have one hundred and twenty acres of corn that will not make a bushel. This is a fair average for this neigborhood.

CHRISTIAN.—July 26th a light rain. Farmers are discouraged.

DADE.—50 per cent of the stock cattle have been shipped out, stock will be wintered on straw and wheat. Another correspondent says no stock cattle have been shipped out.

DOUGLASS.—Nothing made but wheat. I think meadows are dead, straw worth $6 per ton. We have not had an inch of rain since April 1st.

GREENE.—Nice shower the 26th, corn almost a failure, apples one-fourth of a crop.

HENRY.—Corn almost a failure, shower on the 17th seemed to scald the corn. Later, good rains have been reported.

JASPER.—Good rain on the 29th, will improve the late corn.

JOHNSON.—Corn generally very poor, 50 per cent of the stock cattle shipped out. Another correspondent reports one and one-fourth inches of rain July 30th. The loss of the corn crop will be heavy but will teach the farmers a great lesson in crop rotation and the improvement of the soil. Many farmers are sowing cane and millet. This correspondent also reports that he has on clover land corn that will make 30 to 40 bushels per acre. Whippoorwill peas are looking fine.

LAWRENCE.—One correspondent says there will not be corn enough raised for seed.

OZARK.—Oats and corn a failure, apples and peaches falling badly. Another correspondent reports the condition of apples 50 per cent.

POLK.—The surplus wheat is about the only feed we have in this county and will be fed to the stock, apples 60 per cent.

ST. CLAIR.—In a residence of 37 years I have never seen a drouth like this.

TANEY.—Good rains 26th and 27th over the northern part of the county, too late to benefit early corn, late corn will make from one-fourth to one-half a crop, upland a total failure.

VERNON.—A small percentage of late corn will make a light crop. Have been having local showers.

WEBSTER.—A good rain on the 26th, will probably get 40 per cent of a corn crop.

WRIGHT.—Good rain on the 20th, greatly improved the prospect for an apple and peach crop.

SOUTHEAST SECTION.

BOLLINGER.—Some are pasturing their corn, with good rains now bottom land would make light crop, unless it rains soon upland will not make fodder, peaches and apples very small.

CAPE GIRARDEAU.—Fruit of all kinds very small, upland corn will not make anything, water for stock very scarce, very few if any cattle shipped on account of the drouth.

CRAWFORD.—There will be a half crop of corn in some parts of the county where local showers have fallen, all ridge crops except cow peas are beyond recovery.

DENT.—Corn will not make one bushel to the acre, water drying up, people are driving their stock to Current River.

FRANKLIN.—Corn very poor, seed crop of clover has not started to grow.

GASCONADE.—Immediate rains would help some few acres of corn.

HOWELL.—Wild pastures fairly good though the grass is drying up, stock could probably be bought 25 per cent lower than six weeks ago.

IRON.—Plenty of grass and water for cattle, no stock shipped out yet, corn is being cut for fodder, the light showers have been an injury to the corn.

JEFFERSON.—No hay worth mentioning except first crop clover, no clover seed, young fruit trees dying, also some forest trees.

MADISON.—First rain in four weeks fell today, July 29th.

MISSISSIPPI.—Melons not hurt much, acreage only 40 per cent of an average. Another correspondent says melons are about gone.

PERRY.—There will be no corn to amount to anything except on bottom land.

REYNOLDS.—But very few cattle have been shipped out of this county. A rain on the 23rd. Most of the corn is about four feet high and in full tassel.

RIPLEY.—Corn crop almost burned up, any amount of rain would not make more than one-fourth crop.

ST. FRANCOIS.—All crops almost a total failure.

ST. LOUIS.—Apples very good, corn about one-fourth of a crop.

SHANNON.—Corn one-fifth of a crop, no cattle shipped yet on account of the drouth.

SCOTT.—Corn and forage crops about burned up, apples good.

STODDARD.—Unless it rains soon corn will be an entire failure.

TEXAS.—Forest trees dying, peaches drying on the trees, good shower the 27th. Another correspondent reports no rains here since April 17th. Wheat the only crop that can possibly be raised.

WASHINGTON.—It is doubtful if rains should fall now if the corn would make one bushel to the acre.

SPECIAL REPORT ON FRUIT CROP.

As stated in the Crop Review a special inquiry was made of a number of the leading horticulturists of the State upon the present condition of the fruit crop. The following is a condensed statement of the replies received:

HON. N. F. MURRAY, President State Horticultural Society, Oregon, Missouri, says:

"In a good fruit year in Missouri I estimate the total value of the fruit sold at $20,000,000. This would not include the value of the fruit consumed by the growers. The loss on apples and peaches alone on account of the drouth, I would place at $4,000,000. This of course does not include the damage to the trees which has been very great in newly planted orchards. Now that we have had rains followed by cloudy weather I look for our apples and late peaches to be good."

HON. D. A. ROBNETT, Vice President Missouri Horticultural Society, Columbia, Missouri, says:

"I am sure that there will not be over one-third of a full crop this time. I cannot tell the loss as what we have this year will bring so much more. Where orchards have been cultivated and sprayed they will bring more than they did last year and the loss is in uncared for orchards. The drouth has caused many apples to fall where orchards were neglected. Apples are small on account of the drouth."

HON. L. A. GOODMAN, Secretary State Horticultural Society, Kansas City, Missouri, says:

"The apple crop in the most favored parts will probably reach 50 per cent but in some districts as low as 10 per cent. Apples seem to be smooth and clear of insects and scab, but they have not grown much on account of the dry weather. Wherever good rains fall the fruit will come out very fair size. The Ozark region and the Northwest part of the State send in the best reports. I find that a great many apple trees are dying, but how serious the injury may be we cannot now tell. The value of the apple crop will probably be cut considerably more than one-half. The peach orchards are affected very much the same as apples and are very small and in some cases are nearly dried up. Where rain is plentiful late peaches will in all probability come out in very good size. The prospect is for a good crop of grapes. I consider a good crop of all fruits in the State worth about $20,000,000. The drouth has injured the crop at least two-thirds."

HON. A. NELSON, Treasurer State Horticultural Society and Member Board of Agriculture, Lebanon, Missouri, says:

"I consider a fair average crop of fruit in our State worth $15,000,000. I have recently visited 800 to 1,000 acres of bearing orchard and I find where the trees have been well cultivated and sprayed, the fruit is in extra fine condition. Where orchards are not cultivated, trees not

pruned or sprayed the crops are very light and poor in quality. This has demonstrated that cultivation and spraying is necessary to produce a crop of No. 1 fruit. Peaches will need thinning. I have had to thin all my three year old trees. The fruit is only about one-half size to date and it will require plenty of moisture to make them full size. I would place the condition of apples at 35 to 45 per cent of a full crop."

PROF. J. C. WHITTEN, Horticulturist to the Missouri Experiment Station, Columbia, Missouri, says:

"The value of a good fruit crop for the State would undoubtedly amount to $20,000,000. The present condition compared with the average are, apples, where orchards have been cultivated, compare very favorably; in untilled orchards the fruit has certainly been injured to some extent, mostly by dropping off and in non-development. Peaches, conditions are much the same as with apples but the dry weather has prevented them rotting as badly as usual, the rot being almost unknown at present. Where vineyards have been given good attention and care there will surely be a fair crop of grapes even though we do not get any more rains. Grapes are above the average condition now because they have so little rot."

BAGBY & SONS, New Haven, Missouri, say:

"We can only give you our opinion of the crop within a radius of 100 miles of here. In some localities the apples are showing some sun scald on the trees. If the present condition continues much longer the crop will be of little value. The grape crop is not altogether an unpromising one, except the berries are as yet undeveloped for lack of moisture. The bunches are well set and in this locality the rot has not appeared. Peaches will be of little value unless we have rains soon, though this fruit recovers from the drouth effects after we have rains much quicker than any other. The dry weather has a tendency to retard the ripening of the fruit, this we regard as a good thing, for premature ripening would render the fruit of no value at all. The season is several weeks late and later rains may develop the peach crop. Where the orchards are cultivated thoroughly the situation is much better than otherwise would have been. So far as we have observed no trees that have received anything like good attention are dying from the effects of the dry weather. We regard it as impossible to place any estimate at this writing on the loss to the fruit growers on account of the drouth and it largely depends on the future conditions, but we feel safe in stating that

with the very best conditions that might prevail from now on, for the district as stated above, will not exceed one-half a crop. We believe our estimate to be conservative and should the present conditions continue until September we would regard the loss as almost total."

HON. S. H. LINTON, Formerly of Marceline, Missouri, but now of Des Moines, Iowa, says:

Taking 1897 as a basis a full crop of all kinds of fruits for Missouri would amount to $35,000,000."

SOW RYE AND HOLD THE STOCK.

There has been a great deal of free advice given to farmers on what to do to mitigate the drouth losses, and while most of it has been timely and good advice, it has all depended upon seasonable rains to carry it out. Missouri farmers, as a rule are not easily discouraged and they are quick to take advantage of anything that will improve their condition. In the July Bulletin we advised the sowing of forage crops to make feed for winter, and while it will soon be too late to do this, a great deal of excellent feed may be produced by sowing oats, rye or wheat for pastures. Rye is perhaps the best for pasture, as it will stand the winter better and will start earlier in the spring. I would advise sowing 1½ to 2 bushels per acre of either wheat or rye for pasture. Sow with a wheat drill, cross drilling, sowing one-half each way. The drilled grain will germinate better and more evenly than that broadcasted and will stand drouth better, stand freezing better, and will not pull out so easily by the stock.

Save the Breeding Stock.—In a great many instances farmers have found it impossible to hold their stock because of the scarcity of water and feed, and perhaps one-third of the stock cattle, and a great many young hogs, have already been sold. Farmers should use heroic means however, to save their breeding stock, both hogs and cattle, for the reason that a good crop next year will bring very high prices for this class of stock. There may not be any profit in wintering a bunch of young pigs on the high priced feed, but there will be a profit on the brood sow that can run on a rye or wheat field and with a very litttle grain be kept in good condition until spring, when she will farrow a litter of pigs that can be carried through the summer on a clover field until a field of early corn has been grown.

Hold Your Cattle.—In about the same way will it pay to hold the breeding cattle. If the farmer is in the dairy business he can probably get enough out of the milk or butter to buy the extra feed, and besides, he will get the benefits of the extra fertilizer on the land and be ready to take his profits on next year's crops, from the dairy, as well as have a nice bunch of high priced calves in the fall. This is a hard blow on dairying as well as other lines of farming, but the wide extent of the drouth will certainly enhance the price of dairy products, and if any class of farmers in the State can afford to hold their cows and feed them well it is the dairymen. Cattle other than milk cows can be taken through in fairly good shape without any grain.

Save the Fodder.—The green corn that is drying up should be utilized by feeding it now while green, where other feed cannot be obtained, and as soon as the bottom blades begin to burn it should be cut and cured, and when thoroughly dry should be put in the barn or in stacks covered with straw, and if taken care of in this way will make a great amount of feed. We do not recommend cutting the corn until it is certain that the fodder cannot further mature or until you see that it is beginning to burn. The better the crop is matured the greater will be its feeding value. This corn can be cut by hand in the usual manner and put in very small shocks to cure, or put in large shocks, putting up a part of the shock and after it cures cutting the remainder; but perhaps the most satisfactory way will be to harvest with the corn harvester and when harvested in this way it is much easier to handle.

THE DROUTH OF 1901.

By A. E. Hackett, Section Director, U. S. Weather Bureau.

The drought which prevailed over the greater part of Missouri from April 18th to July 27th, 1901, a period of 100 days, was one of the worst and most disastrous in the history of the state. From April 1st to 17th the weather was generally cold, stormy and disagreeable and snows and heavy rains left the soil cold and clammy and in poor condition for cultivation or to withstand long continued dry weather. It was difficult to properly prepare the ground for planting, and where it was not well pulverized it became packed and baked. From April 18th to May 3rd practically no rain fell, except in a few scattered localities. Showers occurred in most sections of the State from May 4th to 11th,

and 15th to 24th, but were generally light, the average rainfall for the state for the month being only 1.48 inches, or 3.80 inches less than the normal. At only a few scattered points did the precipitation of the month exceed 50 per cent of the normal amount, while over a large portion of the State it was less than 25 per cent, and in some localities in the central and southeast sections it was less than 10 per cent. Over a large area extending across the State from north to south the total for the month was less than 1 inch. At St. Joseph, Mexico, Shelbina, Hermann, Boonville, Glasgow, Sedalia and Ironton, where observations have been continued for more than twenty years, and also at Miami, where they cover a period of fifty-three years, it was the driest May on record.

Over the extreme northern counties the total rainfall during June ranged from 4 to over 5 inches, exceeding the normal amount in a few localities, but a majority of the central and southern counties received less than 2 inches, while in some localities there was less than 1 inch. Over the greater portion of the central and southwest sections, and in many localities in the northern and eastern sections, the precipitation was less than half the average amount, many districts receiving only 10 to 25 per cent, and throughout the greater part of the central and southern sections it was the driest June of which there is any record.

Complete reports for July are not yet available but such data as are at hand indicate that over a large portion of the State the rainfall, up to the 27th, was little more than one-fourth the normal amount for that period.

Up to June 20th the weather was generally cool, but from that date to July 25th it was extremely warm, maximum temperatures of 100 degrees and above occurring in portions of the state on every day, the highest thus far reported being 116 degrees, at Marble Hill on July 22d. It is doubtful if so long a period of extreme heat has ever before been experienced by the people of this State.

The following table gives the total rainfall and the percentage of the normal, for each month during the drouth, at selected stations of the Weather Bureau representing the various sections of the State.

RAIN FALL DURING DROUTH.

Stations.	April 18th to 30th.		May.		June.		July 1st to 27th.		For the Entire Period.	
	Total Precipitation.	Percentage of Normal.	Total Precipitation.	Percentage of Normal.	Total Precipitation.	Percentage of Normal.	Total Precipitation.	Percentage of Normal.	Total Precipitation.	Percentage of Normal.
Maryville	T	0	3.76	51	4.90	1.15	3.99	82	12.65	70
Trenton	T	0	1.81	30	4.85	1.19	0.12	4	6.78	45
Keokuk (Ia.)	.02	1	1.95	45	6.34	1.47	0.10	2	8.41	60
Kansas City	0	0	0.75	17	2.54	50	0.90	26	4.19	28
Columbia	T	0	0.35	7	1.23	24	1.79	50	3.37	22
Shelbina	0	0	0.90	17	2.50	48	1.80	43	5.20	32
St. Louis	0.35	19	2.69	58	3.92	79	1.47	44	8.43	58
New Haven	0.11	6	1.19	22	2.67	59	1.53	44	5.50	36
Eldon	T	0	0.36	6	0.67	13	0.26	6	1.29	7
Harrisonville	0.34	19	2.28	49	0.59	13	0.96	27	4.17	29
Arthur	T	0	2.54	40	0.56	7	0.92	25	4.02	20
Springfield	0.29	14	3.04	51	3.39	67	1.29	32	8.01	47
Ironton	0.43	25	0.47	9	2.36	45	1.35	33	4.61	27
Cairo, (Ill.)	0.30	16	2.00	50	0.91	20	1.21	47	4.42	33

NOTE: "T" indicates a trace.

PART II.

TUBERCULOSIS AMONG MISSOURI CATTLE.

By Dr. D. F. Luckey, State Veterinarian.

The examination of breeding and dairy herds in different parts of this State during the past year has revealed the presence of tuberculosis to some extent. It has been thoroughly demonstrated that the disease is contagious from one animal to another and evidence points to the fact that many cases of tuberculosis in the human family are due to the use of tuberculous milk and meat. The danger of the monetary loss by the infection of valuable herds of cattle and the probability of the transmission to the human family makes this disease one of paramount importance to the people of Missouri at the present time.

In the spring of 1900, with a view to stopping the further introduction of tuberculosis among our herds, the Missouri State Board of Agriculture adopted certain quarantine regulations restricting the shipment of cattle from the Eastern states into Missouri. More from the lack of a proper understanding of the dreaded disease than anything else a number of prominent cattle men over the State made objections to the existence of these quarantine regulations and as a consequence they were rescinded. According to what information cattlemen were able to get through the papers in regard to this disease, it is not surprising that they objected to regulations which seemed to them to be unjust and which, they were led to believe, were promulgated for the purpose of creating positions for veterinarians. Their objections were unquestionably due to the honest resentment which they felt.

While the State Board and the State Veterinarian have decided views in regard to the contagious nature of tuberculosis, the reliability of the tuberculin test and the necessity of taking proper steps, in due time, to prevent the introduction and spread of tuberculosis among our cattle, their actions, in the past, have been and, in the future, will continue to be governed by the will of the people. A full discussion of this subject of tuberculosis is given here that it may be properly understood by everybody and by the cattlemen in particular. Once the disease is thoroughly understood and the necessity for restricting its spread fully comprehended there is no doubt but what the people will uphold the sanitary authorities in enforcing any practical regulations.

IS TUBERCULOSIS CONTAGIOUS?

In regard to whether or not tuberculosis is contagious, no one, who has made a study of the disease, can have a single doubt. The fact that it is so subtle in the manner of its spread makes it all the more dangerous. It will be impracticable to demonstrate to the eyes of the average cattleman to an absolute certainty that the disease is contagious. He will have to rely upon the veracity of scientists who, in making their investigations, are looking for the truth. The germs which cause tuberculosis can, with the aid of the microscope, be seen as plainly as the farmer can see the grains of oats which he holds in his hand. By those who familiarize themselves with the appearance of the germs of diseases the bacillus of tuberculosis can be distinguished from the germs of other contagious diseases as easily as a farmer can tell a black grain of oats from a white one. When the germs of tuberculosis are introduced into the animal economy, either artificially or through natural processes, the consequent development of the disease is certain and as thoroughly studied out and understood by the scientist as the germination and growth of a crop of oats is understood by the farmer. In thousands of experiments scientists have, by way of research, planted the germs of tuberculosis in the systems of one and all of the lower animals. He has returned later to find that the germs have multiplied and the disease developed. The farmer prepares his ground and sows his oats. Later on he returns to his field and finds that he has a crop of oats. Some farmers have stood up and said that tuberculosis is not contagious. Suppose a scientist should presume to tell a farmer that his crop of oats were not due to his planting the seed under proper conditions? Suppose a scientist should leave his laboratory to edit a paper and fill it up with long articles advising the farmer to let the usual start of burdock alone, that it would not spread from one field to another? Then if the farmer showed a disposition to go ahead and try to eradicate the pesky weed, suppose the editor should attack his honor and integrity and judgment? He would feel then what the veterinarians have often been made to feel in regard to the subject of tuberculosis.

The tests of dairy cattle which I have conducted show that, when the disease is once introduced into a herd, it spreads rapidly, no matter if the best sanitary conditions are maintained. In one dairy which was tested last summer 56 out of 94 head were tuberculous. The disease had been introduced into this herd less than a year. The sanitary conditions were the very best. The floor of the dairy barn was made of cement and was thoroughly cleaned every day. The ventilation was also good.

Yet the disease spread so rapidly that over half of the cattle became affected in less than twelve months. In some of the herds where the cattle were poorly nourished and were surrounded by the poorest sanitary conditions none were tuberculous. This is mentioned to show that it is only necessary to get the germs introduced into the herd to start and spread the disease and that it will not occur without them. It is as impossible to have tuberculosis in a herd of cattle without the introduction of the bacillus tuberculosis as it is for a farmer to have a crop of oats without first introducing the seed into the ground. When the germs are introduced, which is usually done by adding tuberculous animals to the herd, the disease is as sure to spread among the cattle as the farmer is to have a crop of oats when he plants the seed under the proper conditions.

I quote here a letter from Dr. S. E. Bennett who is in charge of all the meat inspection in the extensive slaughter houses of Kansas City. This letter was in reply to one I wrote him asking for the rules governing the meat inspection and for an instance of the spread of tuberculosis by contagion.

U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF ANIMAL INDUSTRY.
LOCAL OFFICE.

KANSAS CITY, KANSAS, JULY 11TH, 1901.

DR. D. F. LUCKEY,
Columbia, Missouri.

SIR.—Replying to your letter of June 11th I desire to state that I have no knowledge of the case to which you refer. While we find a great many cases of tuberculosis in hogs and cattle we have never been able to ascertain from what locality the hogs were shipped as these animals are killed in the packing house in such a way that no record is kept of any particular lot. But in cattle we have been more fortunate as the lots are kept separate and we have been able to locate the feeding point of several lots that were badly affected. For instance, one lot of 77 fat steers, fed at Hutchinson, Kansas, contained fifteen tuberculous animals which undoubtedly goes to show that this disease is highly contagious. Concerning the presence of this disease in hogs I might say that we usually have good and bad days, as we may find very few if any cases some days, then again we may find as many as forty or fifty cases in one day. In one house we found thirty-two cases in thirteen hundred hogs killed. These were tanked. Yet in this thirteen hundred hogs fifty-three cases of tuberculosis were observed. In the work of inspection, where we find the lesions confined to one organ and the carcass is a good one we pass such animals. All animals showing lesions in two or more organs, as for instance, the glands of the head and lungs or liver and spleen, are condemned and tanked. I do not think any in-

spector is justified in passing any animal affected with tuberculosis without making a thorough and complete examination of the various organs and lymph glands, after which, if he finds that the disease is confined to one organ or one gland, he may pass the carcass as fit for food. It might be interesting for you to know that during the months of May and June fourteen hundred and seventy-six hogs were condemned here as unfit for food on account of tuberculosis. Of course a great many light cases were passed. During these months 722,143 hogs were killed.

If there is anything else you would like to know concerning the work here will be pleased to hear from you.

Very respectfully,
S. E. BENNETT.

THE TUBERCULIN TEST.

In regard to the tuberculin test I will say that, except the rise in temperature in tuberculous cattle, I have noticed no more bad results from the injection of tuberculin than would be caused by the injection of he same amount of distilled water with a sterilized syringe. A few days ago I sent out a circular letter to the cattlemen for whom different veterinarians in the sanitary service in this State have tested cattle and asked the following questions:

How many cattle did you have tested?

Did the test injure any of your cattle in any particular?

The following are the replies which have been received at this office up to the present time:

Chillicothe, Missouri, July 21st, 1901.

Dr. D. F. Luckey,
Columbia, Missouri.

Dear Sir:—In reply to your favor of the 20th instant, will say that I had 45 head of cattle tested for tuberculosis. None of the cattle were injured in any respect by the test.

Very truly yours,
GEO. D. MINOR.

Fayette, Mo., July 22nd, 1901.

Dr. D. F. Luckey,
Columbia, Missouri.

Dear Sir:—I had 70 head of cattle tested for tuberculosis in 1900 and not one single animal was injured in the least. The test was made by yourself.

Yours truly,
N. W. LEONARD.

Fayette, Mo., July 24th, 1901.

Dr. D. F. Luckey,
Columbia, Missouri.

Dear Sir:—Your letter of recent date received. I had 34 head of cattle tested for tuberculosis and if the test injured any of them in any respect it was not noticable.

Yours sincerely,
J. S. BASKETT.

Joplin, Mo., July 22nd, 1901.

Dr. D. F. Luckey,
Columbia, Missouri.

Dear Sir:—Your favor of July 20th at hand. I had tested for tuberculosis 99 head of milch cows and the test did not injure them in any respect.

Very truly yours,
D. J. GULLEY.

Joplin, Mo., July 22nd, 1901.

Dr. D. F. Luckey,
Columbia, Missouri.

Dear Sir:—Replying to your favor of recent date, will say that I had 100 head of cattle tested for tuberculosis. The tuberculin test did not injure my cattle in any particular.

Yours truly,
J. W. CHAPMAN.

As probably very few cattlemen have had a chance to understand what is meant by the tuberculin test I will make this brief explanation of it. Tuberculosis develops so slowly that it is impossible, except in advanced cases, to detect it by an external examination. As it is communicated by cattle in the early stages as well and an external examination does not reveal its presence the tuberculin test becomes a necessity. It is as follows: In testing a herd of cattle I take the temperatures of the whole herd three times during the afternoon of the first day. At from seven to ten o'clock that night I make the injection of tuberculin. At about nine hours after the injection I begin to take the temperatures again and take them every two hours until those that show a rise get to their highest. The temperature of the animal when first taken is usually around 101 degrees, varying somewhat in different animals. In healthy animals the temperature should be the same after the

injection as before it. A marked rise in the temperature after the injection is almost absolute proof of the existence of tuberculosis.

Now it is very evident that tuberculosis exists among the cattle of Missouri to some extent. Fortunately it has not become wide spread. As it is very contagious, what is already here will gradually spread and an occasional new supply will be brought in by imported cattle. If let alone, it is only a matter of time when tuberculosis will become wide spread among the cattle of this State, and to a greater or less extent, menace the health of the human family.

Besides the danger of the loss of cattle which would be caused by the spread of tuberculosis and the danger of the communication of the disease to the human family the pure bred cattlemen have another care.

Missouri is filled up with the choicest herds of pure bred cattle which is shown by the fact that it was Missouri cattle which took nearly all the premiums at the Omaha Exposition. The southern and western states afford the principal market for this stock. The cattlemen of those states will pay more money for pure bred stuff out of a herd which has been kept scrupulously clear of tuberculosis. The neglect on the part of the pure bred cattlemen of Missouri to take the proper precautions to keep their herds free from tuberculosis can only result in their having to accept lower prices for what they have to sell. Too great a neglect of a herd which once becomes infected will result in the loss of almost the entire herd.

Dr. Leonard Pearson, State Veterinarian of Pennsylvania, and a former citizen of Missouri is among the best authorities on the subject of tuberculosis. I herewith print a paper which he read before the Inter-State Association of Live Stock Sanitary Boards at its meeting in Chicago in October in 1899. I commend this article to the consideration of the cattlemen of Missouri hoping that after a careful study of it they will lend their hearty co-operation to the sanitary authorities of this State in the formulation and enforcement of whatever regulations may be needed to protect the State from so great a scourge.

THE CONTROL OF TUBERCULOSIS.

"Although the general subject of tuberculosis of cattle has been discussed in so many papers and at so many meetings during the past few years, I feel that the magnitude and importance of the question justify its frequent consideration until there is greater crystallization of opinion and union of effort in regard to the main points of the situation. And perhaps a brief review of an actual endeavor to check the progress of this disease may not be entirely without value.

"If no exact observations were recorded in regard to tuberculosis, if no careful scientific inquiries and investigations as to the multitudinous bearings of this disease were being made and reported and if no effort to repress tuberculosis were actually under way, it would be possible for the theorizers and disputants to wrangle endlessly over these questions. But when the established facts in relation to tuberculosis are held in clear view, and are used to measure individual opinions and recommendations as they are put forth, only those that rest on premises that have stood the most searching tests that the scientist and economist can apply will receive earnest attention. It is, therefore, of the highest importance that the main points in regard to tuberculosis, and especially those upon which repressive measures must depend, shall be presented as clearly and distributed as widely as possible. Although many of these points are established beyond controversy and are accepted by all who have studied the subject, they are still not as generally appreciated as they should be. This need not surprise us when we recall that but a few years have elapsed since Koch's epoch making discovery of the tubercle bacillus and the establishment of the identity of the human and animal tuberculosis. And when we recall the further fact that not a decade has passed since the discovery of tuberculin and that most of our knowledge as to the extent to which tuberculosis is distributed among animals has been obtained during this period, it no longer appears strange that the public fails to recognize facts that were unknown to the specialist such a short time ago.

"The importance of the cattle tuberculosis problem is two-fold: First, tuberculosis in meat producing and dairy cattle constitutes a menace to public health, and, second, the cattle industry suffers seriously on account of the extensive prevalence of this disease.

"As to the first point, there is no lack of observation to show that the products of animals in certain stages of tuberculosis contain tubercle bacilli, and it has been shown by the observation of numerous cases under natural conditions, as well as by definitely controlled experiments, that the ingestion of such material by animals may be followed by the development of tuberculosis. It is also known from accidental inoculations sustained by men that the tubercle germs from cattle may produce tuberculosis in a fatal form in man. Moreover, there are instances in which people who have consumed the milk from tubercular cows have contracted tuberculosis when no other source of the disease was apparent, and all of the history pointed to infection from milk.

"Most powerful evidence of the existence of this danger and the operation of this cause of mortality is furnished by the records of the

General Registry office of England, as published by the last Royal Commission on Tuberculosis in 1898. It is shown by these records that the deaths from all forms of tubercular disease in England and Wales have diminished 59.1 per cent. in the last thirty-five years, a period of great sanitary advance in respect, especially, to habitations in towns and cities. The greater portion of this very gratifying diminution was in the lung form of tuberculosis or phthisis. On the other hand, the diminution in the intestinal form, or tabes mesenterica, has, in the same period, been but 8.5 per cent., and at one period of life, before the end of the first year, there has been an actual increase in this disease of not less than 27.7 per cent. If infants derive tubercular infection only from their associates and attendants, or, at any rate, from other persons, it is fair to expect the diminution in prevalence to be in proportion to that among their elders. As this is not the case, and as there is actually a large increase in mortality from tubercular disease during the period when milk constitutes the chief article of diet, this food is thus, in the opinion of the members of the Royal Tuberculosis Commission, placed under the strongest suspicion.

"As to the direct injury to the cattle industry and the monetary loss caused by tuberculosis these, as the danger alluded to above, are in direct ratio to the prevalence of the disease. Unfortunately, no accurate statistics are available as to the general distribution of tuberculosis among cattle of the United States. We have, however, the reports on a vast number of tests of scattered herds, the slaughter house records of the Bureau of Animal Industry, a few reports from slaughter houses under local control, and the estimates of a number of veterinarians who have had long experience with this disease in large districts. It is not possible to go into the details of these reports in this summary but it may be said that tuberculosis prevails most extensively among cattle near the Atlantic sea-board and the old dairy districts. It becomes less prevalent towards the west and is almost unknown on the prairie farms of the far west, and among the range cattle of the plains and mountainous country beyond. The extent of prevalence in the old dairy sections of the east appears to be in direct proportion to the activity of cattle traffic. If it is the practice of herd owners to buy their cattle, or if, in breeding herds, there has been a considerable interchange of cattle with other herds, tuberculosis abounds. If, on the other hand, it is the practice, as in many large sections, to rear dairy cows on the farms on which they are used and the current of the cattle trade is outward rather than inward, tuberculosis does not exist or it is a rare disease.

"To illustrate this point, I may refer to a large Jersey herd near

Philadelphia. This herd was established about twenty-five years ago and consists of more than one hundred cattle. It is in a county in which there is as much tuberculosis as in any county in Pennsylvania. The herd is increased by breeding and not by purchase, excepting a bull occasionally, and, as has been shown by a tuberculin test, it is entirely free from tuberculosis.

"In many of the interior valleys of Pennsylvania a large number of herds have been tested without finding a single tubercular cow. These valleys are breeding districts, their cattle are principally of stock that was brought in by the early settlers many years ago, and the trade in cattle is outward. In other sections of Pennsylvania and other eastern states, tuberculosis is very common; some herds have been almost completely exterminated by it and in certain restricted localities it exists on almost every farm. Notwithstanding the extent to which it prevails in some sections and the fact that it has brought ruin to many farmers, I do not think that the distribution among all the cattle of Pennsylvania exceeds about 2.5 per cent.

"Tuberculosis has spread very rapidly among cattle in this country during recent years. Of this I am convinced by the statements of veterinarians, butchers and stockmen of many years' experience. While it is necessary to recognize the fact that much of this testimony is inaccurate it cannot be denied that much of it is of value and that practically all of it points in the same direction. Moreover, I have myself been able to trace the infection of numerous herds to a single source in localities recently infected. In one instance, the infection of seven herds in widely separated places in Pennsylvania, including three districts in which tuberculosis was previously unknown, was traced to a famous herd of cattle that was broken up and sold at auction. It was afterwards ascertained that this herd was almost saturated with tuberculosis.

"It is natural that tuberculosis should spread at a constantly increasing rate as the centers of infection multiply, unless active measures are taken to check it. As proof of this, we have the experience of the countries of Europe. The slaughter house records of France, Holland and Germany show that tuberculosis of cattle and swine has increased enormously in the past ten years and in some places from 30 to 40 per cent. of all cattle killed are tuberculous. Denmark is one of the few European countries where, thanks to the valuable original methods of Prof. Bang, the disease is actually being repressed.

"Unless this cancer on our herds is to be permitted to develop until the annual losses occasioned by it are increased many fold and the conditions that now exist in Europe and in many parts of this country, be-

come common, *something must be done.* As to *who* shall take whatever action is authorized, there can be no doubt that under present conditions the bulk of the work will fall upon state officials rather than upon those connected with the federal or with the local governments.

"The federal government is doing very effective work in this connection by keeping tuberculous cattle out of the country and in assisting in the control of interstate shipments and in conducting careful meat inspection in many places, but it has not yet taken active part in the suppression of tuberculosis in already infected herds. Nor have local governments taken up this work seriously other than New York City, Philadelphia, and, perhaps, a few other municipalities. Under the conditions prevailing and in view of the precedents already established, it is probable that this work must be looked upon as state work for some time to come, although it is to be hoped that the Bureau of Animal Industry can eventually assume more of the responsibility for the examination of cattle, or at least of dairy cows and cattle for breeding purposes, shipped from one state to another.

"Certain objections have been raised to public action in relation to tuberculosis and these may be formulated as follows:

A. Objections to all public measures.
   1. It is alleged that they are unnecessary.
   2. It is alleged that they cannot succeed.

B. Objection to certain measures.
   1. To the use of the tuberculin test on the alleged grounds,
      a. that it will injure healthy cattle;
      b. that it is not infallible, and,
      c. that it is too searching.
   2. To the payment of indemnity for animals condemned and destroyed.

"A. 1. As to the first point, there are some writers and speakers who deny that tuberculosis is anywhere a wide-spread or even a serious disease among cattle. The tuberculosis question has now been discussed so much that such statements can be accounted for only by the assumption that their authors wilfully disregard knowledge that they may easily acquire and in this case, it is useless to discuss the subject with them.

"Another objection, but a sincere one, that falls under the same heading, is based on the belief of some that tuberculosis of man and cattle are distinct disease, or, perhaps, such distinct varieties of the same disease that there is no danger that this affection may be transmitted from cattle to man. Quite recently this argument has been taken up in force by writers in agricultural papers as a result of the expression of an

opinion before the legislative committee appointed to inquire into the tuberculosis question in New York State. This opinion is to the effect that there is no danger that tuberculosis of man may result from the ingestion of the milk of tuberculous cows, and is supplemented by the statements of several gentlemen who had owned tuberculous cows and had used the milk in their families, and otherwise, and had observed no bad results. If the matter were only one of opinion it would be sufficient to arrange the opposing opinions in two sets and weigh one set against the other, having due regard for the standing, attainments and experience of those responsible for them, somewhat after the manner of a French court-martial. If this were done, there can be no doubt that the weight of evidence, as is shown by the expressions at the recent tuberculosis congresses in Paris and Berlin, would support the doctrine of transmissibility. But the question is not one of opinion, but of fact, and opinions count only as they have facts to support them. In this connection, we must remember that a positive observation records a fact and is worth innumerable negative observations. If a man should say, for example, that he and many of his friends had traveled without injury on railroads for years and that he did not believe in railroad accidents, there would be little consolation in this statement to the man whose child was killed in a railroad wreck, no matter how many endorsements the opinion might have. Thousands have been exposed to cholera and yellow fever without injury. Does this prove that these diseases are not contagious?

"When it is said that if tuberculosis was carried by the milk of tubercular cows there would be far more tuberculosis among milk consumers than there is, we must bear in mind that the great majority of cows are not tubercular and that only a certain percentage of the tubercular ones furnish milk that contains tubercle bacilli. And we must not forget that tuberculosis is extremely prevalent among people and that while it kills from one-eighth to one-seventh of mankind it is even more prevalent than these figures indicate for tubercular lesions exist in many people that die from other causes. If there are those who hesitate to believe that tuberculous milk may cause tuberculosis on account of the alleged limited prevalence of this disease among people, how many people would have to become tubercular to convince them? At present, tuberculosis is the most widespread and fatal disease of man—a veritable scourge.

"As to the identity of the tubercle bacilli from tublercular men and cattle, the observations on this phase of our subject cannot here be reviewed in detail and it is perhaps sufficient to say that they were declared to be the same in 1882 by Koch, their discoverer, and that since that

time this view has been held by almost all bacteriologists, and no points of difference have been pointed out by any one who has studied these germs in any part of the world that are even as great as those observed between the germs of many diseases that are confined to but one species of animals. Such comparative observations and experiments as to virulence as have been made with tubercle bacilli from cattle and man indicate that, as a rule, the former are the more virulent. The germs of tuberculosis of cattle have been transmitted by either intentional or accidental inoculation to, and have produced fatal tuberculosis in horses, donkeys, swine, cats, dogs, sheep, goats, rabbits, guinea pigs and man. The milk from tubercular cows has been the cause of tuberculosis in numerous feeding experiments performed on calves, swine, dogs, cats, colts and other animals. The type of lesions produced in such cases have been observed in children and in others that have consumed milk from tubercular cows, and in many of these cases no other source of the disease was evident. To those who ask for further proof of the transmission of tuberculosis from cattle to man there can be but one convincing demonstration, and that could be obtained only by a deliberate feeding experiment on a person known to be free from tuberculosis and protected from all sources of infection excepting through the food, it is needless to say that this piece of evidence will not be adduced.

"It is generally believed that usually people who contract tuberculosis are infected by way of the respiratory tract and that infection by food is rare except among infants and invalids. It is undoubtedly true that in a large measure the general health of a person determines his resistance to the attacks of the tubercle bacilli when introduced into the digestive or respiratory passages. It is natural, therefore, that as houses and workshops are improved in respect to lighting, ventilating, heating and cleanliness, and as the contagious nature of tuberculosis is recognized more and more, the disease should become less prevalent—and this has actually happened during the past twenty-five years and to marked degree. In the meantime, tuberculosis of cattle has been on the increase. Does this, as is frequently claimed, show the fallacy of the view that tuberculosis of cattle has some causal relation to tuberculosis of man? Evidently not, unless it is held that tuberculosis of cattle is the principal cause of tuberculosis of man. If the reserve fund of a bank is constantly falling, does this show that a particular depositor has reduced his patronage? Since there are more productive causes of tuberculosis in man than the milk from tubercular cows, is this a reason why this source of disease should not be removed?

"2. In reference to the objection to all public action on the ground

that it cannot be successful, it is well to consider the reasons upon which this allegation is based. It is claimed, for example, that tuberculosis is produced by bad conditions as to stabling and herd management or that these conditions are indispensable to its development and progress and that, therefore, the disease cannot be held in check until what the advocates of this view term 'the root of the trouble' is cut off. That is, until farmers have clean, well lighted and ventilated barns and keep their cattle in a 'natural' way it is useless to attempt to limit this disease. This view is carried so far by some that they hold that tuberculosis may originate *de novo* when the conditions as to stabling are bad.

"This ground has been gone over so often since 1882 that it is useless to cover it at length here. As sufficient proof that these views will not stand a test, I have only to call your attention to the well known fact that many of the most extensively tuberculous herds have been kept in the best possible barns and subject to conditions that, in the light of our present knowledge, must be looked upon as perfect, with the exception that tubercular animals were not rigidly excluded by the application of the tuberculin test when the herds were established. As a recent notable example of such an incident I may cite the case of the Queen's dairy herd at Windsor. As a matter of fact, tuberculosis may spread under the best practicable stabling conditions.

"On the other hand, the tuberculin test has been applied to a large number of herds in Pennsylvania that are kept under the worst conditions and has, in many instances, failed to disclose the presence of a single tuberculat cow. As coming under such bad conditions I may mention continuous stabulation for six months each year; close, dark and filthy stables and high and stimulating feeding on mill feeds and ensilage. Where herds kept in this way are sound, it is because it has not happened that a tubercular cow has been added to them.

"Another objection of this class is that no matter how thoroughly tuberculosis is eradicated among cattle it will soon return unless they are excluded from direct or indirect contact with tubercular people, tubercular dogs, cats, rats, swine, horses, etc., etc. As a matter of fact, though there are very many recorded instances in which tuberculosis has undoubtedly passed from cattle to other animals, and there is abundant proof that tubercular cattle are the chief source of tuberculosis in other animals which consumed their milk or tubercular tissues. I have not found one reported case in which it was even suspected that tubercular disease had passed in the opposite direction. While the theoretical possibility of such transmission cannot be denied, cattle are not exposed to infection from other animals, first, because they do not consume their products, and, second, because they do not associate with them closely, as with